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ABSTRACT

A total, systematic, integrative concept provides the framework for this definition of educational technology as a theory, a field, and a profession. The definition statement presents an historical perspective of attempts to define educational technology and a current theoretical framework for arriving at a definition. It also identifies the intellectual techniques and practical applications derived from the theoretical framework and describes the training and certification, the ethics and standards, the leadership, the association and communications, the acknowledgement as a profession, the concern of the profession, and the relationship to other professions that both derive from the theoretical framework and exist in the field today. An evaluation of the definition statement concludes this document by the AECT Task Force on Definition and Terminology; a list of references and a glossary of terms not defined within this definition statement are appended. (Author/BK)

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THE DEFINITION OF EDUCATIONAL TECHNOLOGY

AECT Task Force
on Definition and Terminology

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dedication

For James D. Finn and Sidney C. Eboch,
who are not here to see
that the pioneering work begun
over 15 years ago
is still continuing.

We miss them for the talents
they could have lent to this edition.
But more than that,
we miss them for themselves.
They were helping,
caring persons
who brought so much to the lives they touched.

As we carry on what they began,
we freely and lovingly acknowledge our debt
and gratitude
to them.

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Preface

> . . . I firmly believe that the future of educational technology is now in the hands of the thinkers. What is needed is a handful of experienced people, who have thought widely and deeply, and who are literally obsessed by the problems posed. These people must have the ability to analyze and synthesize, and, in effect, to *invent whole new conceptual frameworks.* If they do not have this latter ability, they will be soon reduced merely to improving what is.
>
> I think this radical rethinking is both a lonely and a high-risk activity. (Lewis, in Hawkridge, 1976, pg. 27; italics added)

The Association for Educational Communications and Technology shares this belief, and consequently has, for the past six years, engaged in the lonely and high-risk activity of attempting to define *educational technology* as a theory, a field, and a profession, and to identify and define terms used in *educational technology.*

This document, *The Definition of Educational Technology,* and the document *Educational Technology: A Glossary of Terms,* are the result of that activity.

OFFICIAL ENDORSEMENT

By a unanimous vote of the Executive Committee for its Board of Directors, the Association for Educational Commun-

cations and Technology endorses this definition of educational technology as its *official* definition.

The Association is committed to a continuous reevaluation of the Definition, and to revising and republishing it within five years, to reflect changing concepts, terminology and definitions in the growing field and profession of educational technology.

NEW CONCEPTUAL FRAMEWORK

In its activity of defining educational technology, the Association did ". . . invent a whole new conceptual framework." It based the definition on the framework of the concept of educational technology and on a model called the Domain of Educational Technology. This framework was chosen because it was seen as being: (a) integrative, rather than delimiting, in orientation; (b) present and future, rather than merely present, oriented; (c) process, as well as product, oriented; (d) theoretically, rather than "job" based, and (e) consistent with the current and future state of society and education. (The specific assumptions and concepts underlying the definition and its framework are presented in Chapter IV.

The Association recognizes that the framework presented here is new, and thus may be initially strange, uncomfortable, and perhaps even threatening, to some readers. Some readers may initially prefer other existing conceptual frameworks to the one presented here.

However, the Association believes that:

(a) this is the best conceptual framework available at this time for defining educational technology.

(b) this conceptual framework can be easily understood and applied by its members; and,

(c) other conceptual frameworks can, with some analysis, be seen to fit within the conceptual framework offered here.

OTHER EXISTING FRAMEWORKS

The Association recognizes that there are, at present, several other sets of conceptual frameworks which are prevalent among

people involved in some way in educational technology.

These concepts include "audiovisual instruction," "educational media," "learning resources," and "educational communications."

It is the belief of the Association that while these are all valid approaches to looking at what we do, "educational technology" is more inclusive and integrative than these other approaches. However, these approaches and those who honestly hold them are to be respected.

It is also the belief of the Association that people who hold these concepts and frameworks will see, as they read this Definition, that they are a part of the total, systematic, integrative concept of educational technology as used here. This notion is especially addressed and further explained in Chapter X, p. 135. In this definition statement, the reader who is unsure about how his/her concept and framework fit into the one used in this Definition should pay careful attention to this section, reading it to answer the question, "How do I, and my concepts and beliefs, fit into the one used here?"

SUMMARY

As a result of 14 years of work, the Association has developed and officially endorsed a definition of educational technology. It is based on a new conceptual framework which the Association believes is the best available at this time for defining the theory, field, and profession of educational technology.

It recognizes that other theoretical frameworks do exist, and that these are valid, but that they are part of the more inclusive theoretical framework of educational technology used in this definition.

Terms not defined within the definition statement are defined in Appendix A, Theory.

Definitions of terms related to educational technology are included in the publication *Educational Technology: A Glossary of Terms.*[1]

The Association offers this Definition and Glossary, then, as

its current position based on the most accurate and complete knowledge currently available. It is committed, however, to a continuous reevaluation of the Definition, and to revising and republishing it to reflect changing concepts, terminology and definitions in the growing field and profession of educational technology.

A document of this magnitude can only be produced as the result of the dedication and effort of the persons who formed the committee and of its chairperson, Ken Silber. Without their energies, skill, perserverance, and willingness to risk stating their perceptions of the field in this format we could not have offered this document. Whether or not we all agree with the statements presented here, they will provide a benchmark and a point of dialogue for further development of the field which seeks to provide effective learning experiences.

Portland, Oregon
July 14, 1976

Richard Gilkey, President
Association for Educational
Communications and Technology

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[1]The definition statement and a glossary of terms related to the development and production of learning resources were originally published as one document, *Educational Technology: Definition and Glossary of Terms, Volume I* (1977). The Glossary has since been expanded to include those terms related to the management of learning resources, and published in its completion as a separate document entitled *Educational Technology: A Glossary of Terms* (1979).

Foreword

Any attempts at definition and terminology are undergirded by a philosophy of and assumptions about *homo sapiens.* For it is humans who conceptualize, organize, and plan. James Finn often referred to Bode, saying "The nature of instruction depends on assumptions about the nature of mind . . . and man."

As people—humankind—engage in their continual search for truth they think, they organize, they structure their world—making the real world to the likeness of their thoughts. Thus this definition is another step, another conceptualization built on the world of those who went before. It represents a point in time, a today based on yesterday and looking toward tomorrow.

Since this growth process is continual, Finn's (1963) insights about definition and terminology are as valid today as they were a decade ago. In his foreword to DAVI's monograph (Ely, 1963) on definition and terminology Finn said:

> The subject matter presented here—definition and terminology in the rapidly growing and swiftly changing field of instructional technology—certainly fits the requirement of importance. And insofar as terminology can be borrowed or created and agreed upon, it can bring much needed stability to the field.

A *field*, as George Gerbner has so often pointed out, is not the same thing as a *discipline* in the world of the intellect. The audiovisual field, like many other fields including public administration, embraces portions of concepts, skills, and procedures from a number of academic disciplines and also from other applied fields and welds them into new applications. In this process, other elements—notably, the beginnings of one or more new disciplines and a great deal of art—are created. Thus, civil engineering is more than the strength of materials, more than theories of molecular resonance; though it must use these, it must also create elements of its own if real bridges of lasting beauty are to be made to cross real rivers.

In the academic disciplines—chemistry, literary criticism, or urban sociology—definition and terminology is a difficult enough problem. These days, all academic disciplines are in a great struggle to become *sciences* with physics as the model. Without commenting on the possible inadvisability of this drive by all fields of knowledge to emulate a system for study of the physical universe, the fact still remains that in any science an agreed-upon universe of discourse is the *sine qua non*. The ideal science or academic discipline is one in which all workers understand perfectly all of the terms in the special language of the science or discipline—a language in which all neophytes or apprentices must be inducted until they, too, reach full understanding. Because models created of the real world rarely, if ever, precisely resemble that world, even the utmost reaches of the "hardest" sciences have never really attained this ideal of a totally agreed-upon universe of discourse.

The problem of an applied field with reference to definition and terminology is infinitely more difficult than the same problem in a narrow and precise discipline. An applied field, by its very nature, draws upon so many sources for its sustenance that the problem of definition and terminology is compounded many times. If the biophysicists do not totally agree in their field, what about the public health people who must apply findings from varied disciplines?

Further, it can be argued that an applied field is subject to the winds of change that may mount to hurricane force and speed. The explosion of knowledge causes the narrowest discipline to change with great rapidity. A human profession making use of several disciplines thus has to live with multiplying change.

At bottom, the problem is even more complicated. Writers on science and even eminent scientists in recent years have created and maintained a myth that there is a one to one relationship between a science and any applied field depending upon that science. That is, scientists advance new theories or discover new facts or processes about some aspect of the world, and engineers then apply these theories, facts, or processes directly as handed down. In education, for example, there is talk about the science of learning and the art of teaching or the technology of instruction.

It is true that in the last 50 years, as the industrial revolution has given way to the scientific revolution, we have increasingly relied upon the scientist as discoverer and understander and upon the practitioner as direct applier without change or question. Their relationship, however, is still far from one to one. The practitioner—be he doctor, engineer, public administrator, or audiovisual director—still adds much to the revolutionary process: Call it invention, technology, art, or a little of all three.

The professional who has to do something in this world further complicates the problem of language, definition, and terminology because he adds terms, concepts and ideas to those selected from the supporting disciplines (pp. iv-vi).

AECT's Task Force on Definition and Terminology has the responsibility for giving both structure and sense to the application of technology to education. Applying technology necessarily affects all parts of the educational enterprise. Finn recognized the scope of this impact:

It follows, then, that definition and terminology in the expanded audiovisual field—instructional technology, if you will—is of crucial importance to the educa-

> tional community as a whole. Does the school superintendent, for example, know what the language laboratory that he has just asked for bids on really is? Does he use *program* in its television sense or its teaching machine or computer sense? (p. vii)

How does instructional design relate to instructional development and how do both relate to curriculum planning? Do summative and formative evaluation differ in respect to time or procedures or both? The need for standard terms and definitions has expanded—not diminished—in past years.

This definition is not offered casually. It has been 14 years in the making. It is the product of people—practitioners in educational technology. Recognizing what is encompassed within the field of educational technology, they represent and have drawn from a wide range of educational specialities. As a product of people at a point in time, the definitions and technology will change and evolve as time goes on. Such changes are welcomed, not discouraged. AECT's Task Force on Definition and Terminology encourages those involved in any phase of educational technology to make themselves heard, to offer comments and ideas, to contribute to an ongoing revision process. Future editions can only be strengthened by the collective input of you, the practitioners in educational technology. Tomorrow is you—become it.

Rochester, New York
January 1, 1977

Clint Wallington

THE DEFINITION OF EDUCATIONAL TECHNOLOGY

CHAPTER I

The Definition of Educational Technology: A Summary

A concept as complex as educational technology requires an equally complex definition. The following definition—all 16 parts—are meant to be taken as a whole; none alone constitutes an adequate definition of educational technology.

1. *Educational technology* is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems and devising, implementing, evaluating, and managing solutions to those problems, involved in all aspects of human learning. In educational technology, the solutions to problems take the form of all the *Learning Resources* that are designed and/or selected and/or utilized to bring about learning; these resources are identified as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems, and devising, implementing and evaluating solutions are identified by the *Educational Development Functions* of Research-Theory, Design, Production, Evaluation-Selection, Logistics, Utilization, and Utilization-Dissemination. The processes of directing or coordinating one or more of these functions are identified by the *Educational Management Functions* of Organization Management and Personnel Management. The relationships among these elements are shown by the Domain of Educational Technology Model:

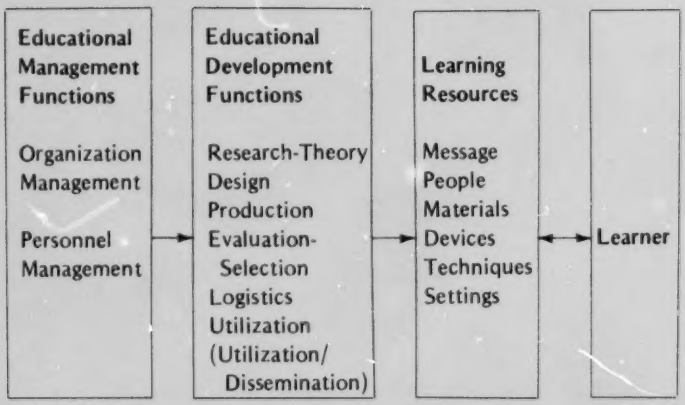

Figure 1.1
DOMAIN OF EDUCATIONAL TECHNOLOGY

The definitions of the elements in the Domain of Educational Technology are given in Tables 1.1, 1.2, and 1.3.

Educational technology is a theory about how problems in human learning are identified and solved.

Educational technology is a field involved in applying a complex, integrated process to analyze and solve problems in human learning.

Educational technology is a profession made up of an organized effort to implement the theory, intellectual technique, and practical application of educational technology.

2. Educational technology is often confused with "technology in education."

Technology in education is the application of technology to any of those processes involved in operating the institutions which house the educational enterprise. It includes the application of technology to food, health, finance, scheduling, grade reporting, and other processes which support education within institutions. Technology in education is *not* the same as educational technology.

3. Educational technology is often confused with "instructional technology."

Instructional technology is a sub-set of educational technology, based on the concept that instruction is a sub-set of education. Instructional technology is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems, and devising, implementing, evaluating and managing solutions to those problems, in situations in which *learning is purposive and controlled.* In instructional technology, the solutions to problems take the form of *Instructional System Components* which are prestructured in design or selection, *and* in utilization, and are combined into complete instructional systems; these components are identified as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems and devising, implementing, and evaluating solutions are identified by the *Instructional Development Functions* of Research-Theory, Design, Production, Evaluation-Selection, Utilization, and Utilization-Dissemination. The process of directing or coordinating one or more of these functions are identified by the *Instructional Management Functions* of Organization Management and Personnel Management. The relationships among these elements are shown by the Domain of Instructional Technology Model:

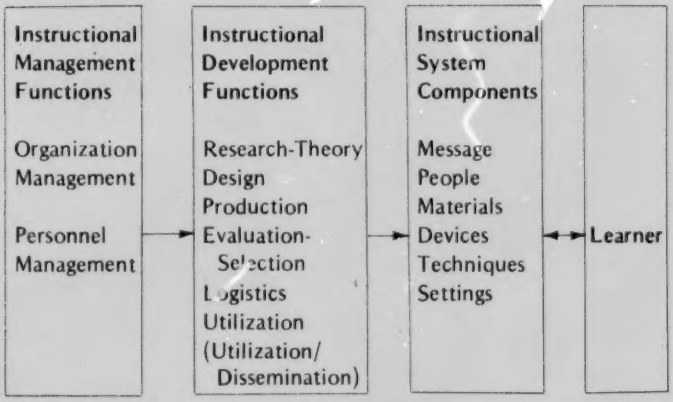

Figure 1.2
DOMAIN OF INSTRUCTIONAL TECHNOLOGY

The definitions of the elements in the Domain of Instructional Technology are given in Tables 1.1, 1.2, and 1.3.

Thus, all of instructional technology fits within the parameters of educational technology, while all of educational technology does not fit within the parameters of instructional technology. If instructional technology is in operation, then of necessity, so is educational technology; the reverse is not necessarily true. In educational technology, the Development and Management Functions are *more inclusive* because they apply to more Learning Resources than just Instructional System Components—they include all resources that can be used to facilitate learning.

4. The definition of educational technology constitutes a Theory because it meets the criteria of: existence of a phenomenon, explanation, summarizing, orientation, systematizing, gap identification, generating strategies for research, prediction, and a principle or set of principles.

5. Educational technology has a unique Intellectual Technique—an approach to solving problems. Each development and management function has an individual technique associated with it. However, the intellectual technique of educational technology is more than the sum of these parts. It involves the systematic integration of the individual technologies of these functions, and their interrelationships, into a complex, integrated process to analyze whole problems and create new solutions. It produces a synergistic effect, yielding outcomes not totally predictable based on the individual elements operating in isolation. This indigenous intellectual technique is unique to educational technology; no other existing field uses it.

6. Educational technology has practical applications. The existence of resources for learning, and the performance of the development and management functions, constitute the most basic and explicit evidence of this practical application. In addition, the application of educational technology affects the organizational structure of education because: (1) it moves the impact of educational technology to the curriculum strategy (and perhaps determination) level; (2) it permits four types of educational patterns—people resources alone, other resources

used by (and controlled by) people, people in shared responsibility with other resources (combined into educational systems using mediated instruction), other resources (mediated instruction) alone; (3) it makes possible the existence of alternative institutional forms for facilitating learning, and can serve all these types of alternative institutions. These applications have significant impact on the specific processes of education: they change the techniques of doing, and the people who do, content determination (including standardization, choice, quantity, and quality), design, production, and evaluation of instruction, and interaction with, and assessment of, learners. The result leads to a drastic change in the role of school systems and the individual teacher.

7. Educational technology has guidelines for training and certification. There is a competency-based framework for training people who perform tasks in educational technology. The framework is based on groupings of tasks from various functions within the domains of educational and instructional technology. The groupings reflect specialties within the field as well as levels of performance within the specialty area. The specialties are: (1) instructional program development, (2) media product development, and (3) media management. The three levels of task complexity are aide, technician, and specialist. AECT currently has guidelines for training programs for, and certification of, technicians and specialists in each of the three specialty areas, and is developing procedures for the implementation of those guidelines.

8. Educational technology has provisions for the development and implementation of leadership. Leadership within the profession is carried out through various leadership conferences and internship programs. In addition, educational technology fulfills a leadership function in the field of education through participation in joint groups, grants, and publications.

9. Educational technology has an association and professional communications. There is at least one professional association directly concerned with educational technology—the Association for Educational Communications and Technology. In addition to facilitating communication among members through its

annual convention and three periodic publications, it serves to develop and implement the standards and ethics, leadership, and training and certification characteristics of the profession.

10. Educational technology acknowledges itself as a profession through its professional association and the activites it performs.

11. Educational technology operates within the larger context of society. It advocates being a concerned profession—concerned about the uses to which its techniques and applications are being put. Further, as a profession, it has taken stands in favor of intellectual freedom, in favor of affirmative action, against stereotyping in materials, and in favor of enlisting technology in support of humane and life-fulfilling ends.

12. Educational technology operates within the total field of education. In its relationship to other professions also involved in the field it advocates a coequal and cooperative relationship among these professions.

13. Since the definition presented here meets all the criteria for the existence of a theory (preceding items 1-4), educational technology is a theory about how problems in human learning are identified and solved. Since the definition meets all the criteria for the existence of a field (preceding items 1-6), educational technology is a field involved in applying a complex, integrated process to analyze and solve problems in human learning. Since the definition meets all the criteria for the existence of a profession (preceding items 1-12), educational technology is a profession made up of an organized effort to implement the theory, intellectual technique, and practical application of educational technology. The definitions of educational technology as a theory, a field, and a profession are congruent—with each being derived directly from the one which precedes it.

14. Persons are members of the field of educational technology if they perform activities that fall within the Domain of Educational Technology, based on the theoretical framework of, and employing the intellectual technique of, educational technology.

15. Persons are members of the profession of educational technology if they already meet the criteria for operating within the field; spend a majority of their time performing one or more of the Domain of Educational Technology functions; subscribe to the standards and ethics of the profession; and have the training and certification required by the profession; are involved in developing their own leadership abilities; are members of the association and participate in its communications through reading its journals and attending its meetings; acknowledge themselves as members of the profession; are concerned professionals—examining the ends to which their skills are put and accepting those values set forth by the profession; and relate to other professionals on a coequal and cooperative basis. These people may be called "educational technologists."

16. "The concept of instructional or educational technology is totally integrative. It provides a common ground for all professionals, no matter in what aspect of the field they are working. It permits the rational development and integration of new devices, materials, and methods as they come along. The concept is so completely viable that it will not only provide new status for our group, but will, for the first time, threaten the status of others" (Finn, 1965, p. 193).

"The educational future will belong to those who can grasp the significance of [educational and] instructional technology" (Finn, 1964a, p. 26).

Table 1.1
Learning Resources/Instructional System Components

Learning Resources (for Educational Technology)—all of the resources (data, people, and things) which may be used by the learner in isolation or in combination, usually in an informal manner, to facilitate learning; they include Messages, People, Materials, Devices, Techniques, and Settings. There are two types: (a) resources by design—those resources which have been specifically developed as "instructional system components" in order to facilitate purposive, formal learning, and (b) resources by utilization—those resources which have not specifically been designed for instruction but which can be discovered, applied, and used for learning purposes.

Instructional System Components (ISC) (for Instructional Technology)—those learning resources which are prestructured in design or selection *and* utilization, and combined into complete instructional systems, to bring about purposive and controlled learning.

Resource or Component	Definition	Examples
Message	Information to be transmitted by the other components; takes the form of ideas, facts, meanings, data.	Any subject matter/content, *e.g.*, the history of the Greeks; Ohm's Law; World Series results; the parliamentary system of government; conjugation of the verb "to be."
People	Persons who are acting to store and/or transmit Messages.	Teacher; student; actor; speaker.

Learning Resources/Instructional System Components

Resource or Component	Definition	Examples
Material	Items (traditionally called media or software) which usually store Messages for transmission by devices; sometimes self-displaying.	Overhead transparency; slide; filmstrip; 16mm motion picture; 8mm motion picture; videotape; record; audiotape; programed instruction materials; computer-assisted instruction program; book; journal.
Device	Items (traditionally called hardware) which transmit Messages stored on Materials.	Overhead projector; slide projector; filmstrip projector; 16mm film projector; 8mm film projector; videotape recorder; television set; record player; radio; tape recorder; dial access information retrieval system console; teaching machine; talking typewriter; computer output devices.
Technique	Routine procedures or precast molds for using Materials, Devices, Settings, and People to transmit Messages.	Computer-assisted instruction; programed instruction; simulation; gaming; discovery; inquiry; field trip; team teaching; individualized instruction; self-instruction; group instruction; lecture; discussion.
Setting	The environment in which the Messages are received.	*Physical:* school building; instructional materials center; library; studio; classroom; auditorium. *Environmental:* lighting; heating; acoustics.

Table 1.2
Educational/Instructional Development Functions

Functions which have as their purpose analyzing problems, and devising, implementing, and evaluating the Learning Resources/ Instructional System Components solutions to these problems.

Function	Definition	Examples
Research-Theory Purpose:	To generate and test knowledge (theory and research methodology) related to the functions, Learning Resources and Instructional System Components and learners.	To conceptualize theoretical models. To conduct research projects. To analyze research data.
Outcome:	Knowledge which can act as an input to the other functions.	To generate new ideas. To test validity of model. To test hypotheses.
Activity:	Seeking information, reading it, analyzing it, synthesizing it, testing it, analyzing test results.	Reads proposal. Compares model with known data. Formulates specific hypotheses.
Design Purpose:	To translate general theoretical knowledge into specifications for Learning Resources or Instructional System Components.	To design programed instruction materials. To develop instructional modules for individualized instruction. To design equipment systems.

Educational/Instructional Development Functions

Function	Definition	Examples
Outcome:	Specifications for production of Learning Resources and Instructional System Components, regardless of format or resource.	To write general objectives. To determine medium. To describe technical systems.
Activity:	Analyzing, synthesizing, and writing objectives, learner characteristics, task analyses, learning conditions, instructional events, specifications for Learning Resources and Instructional Systems Components.	Analyzes objectives. Synthesizes objectives/sequence/content/media. Arranges materials in sequence.
Production Purpose:	To translate specifications for Learning Resources or Instructional Systems Components into specific actual items.	To produce audiotapes. To direct motion picture. To write computer programs for computer-assisted instruction.
Outcome:	Specific products in the form of test versions, prototypes, or mass-produced versions.	To make slides into test filmstrips. To decide on music/sound effects. To match audio and visuals.
Activity:	Operating production equipment, drawing, laying out, writing, building products.	Mixes narration tape and sound. Sequences slides using viewer. Operates motion picture camera.

Educational/Instructional Development Functions

Function	Definition	Examples
Evaluation-Selection Purpose:	To assess acceptability of actual produced Learning Resources or Instructional System Components in terms of criteria set by other functions, and to develop models for this assessment.	To pilot test prototype instructional materials. To preview and select instructional materials. To develop evaluation models and techniques.
Outcomes:	(a) Evaluation for Design: effectiveness of Learning Resources or Instructional System Components in meeting their objectives. (b) Evaluation for Production: acceptability of items in meeting production standards. (c) Evaluation for Evaluation: evaluation models. (d) Evaluation for Selection: acceptability of items for acquisition for a specific purpose. (e) Evaluation for Utilization: acceptability of items for meeting learning objectives in actual use.	To identify problems with materials. To identify objectives not met. To insure acceptable sound quality.
Activity:	Analyzing quality in terms of standards.	Observes students using materials. Analyzes possible uses of materials. Compares data and objectives.

Educational/Instructional Development Functions

Function	Definition	Examples
Logistics Purpose:	To make Learning Resources and Instructional System Components available for other functions.	To have equipment ready as needed. To provide delivery service. To catalog materials.
Outcome:	Ordered, stored, retrieved, classified, catalogued, assembled, scheduled, distributed, operated, maintained, and repaired Learning Resources and Instructional System Components.	To cross-index materials. To locate materials for delivery. To keep repair history. To repair filmstrip projector.
Activity:	Ordering, storing, retrieving, classifying, cataloging, assembling, scheduling, distributing, operating, maintaining, repairing Learning Resources and Instructional System Components.	Threads movie projector. Assigns media code from list. Plans new scheduling system.
Utilization Purpose:	To bring learners into contact with Learning Resources and Instructional System Components.	To help student use learning activity. To monitor individualized and self-instruction. To help student select learning activities and to meet objectives.
Outcome:	Facilitation and assessment of student learning.	To analyze student learning style. To present information. To encourage interest in learning activity.

Educational/Instructional Development Functions

Function	Definition	Examples
Activity:	Assigning, preparing learner for, presenting, assisting, and following up Learning Resources and Instructional System Components; testing learners.	Discusses with student. Compares learning activities with learning style. Compares pre- and post-tests.
Utilization-Dissemination Purpose:	(A special subfunction of Utilization.) To bring learners into contact with information about educational technology.	To consult on materials design and use. To teach photography course. To explain individualized instruction project. To increase use of learning resources center services by teachers.
Outcome:	Dissemination of information about educational technology.	To provide models for designing instruction. To improve use of mediated instruction by teachers. To answer questions about individualized instruction project. To demonstrate projector. To explain learning resources center services to teachers.
Activity:	Taking in and giving out information about educational technology.	Defines learning resources center services available. Writes professional articles. Views microteaching lesson. Role plays teacher using mediated instruction.

Table 1.3
Educational/Instructional Management Functions

Functions which have as their purpose the directing or controlling of one or more of the Educational/Instructional Development Functions or of other Educational/Instructional Management Functions to ensure their effective operation.

Function	Definition	Examples
Organization/Management		
Purpose:	To determine, modify, or execute the objectives, philosophy, policy, structure, budget, internal and external relationships, and administrative procedures of an organization performing one or several of the Development functions or the Management functions.	To administer/direct project which includes two or more functions. To monitor and change operation of center. To provide secretarial services in an audio-visual center.
Outcome:	Policy, budget, plans, coordinated activities, administrative operations.	To prepare budget. To identify organization needs. To ascertain jobs to be done.
Activity:	Defining, writing, and carrying out procedures leading to the outcomes.	Reviews purchase orders. Designs new organizational model. Analyzes problems in project.

Educational/Instructional Management Functions

Function	Definition	Examples
Personnel-Management		
Purpose:	To interact with and/or to supervise the people who perform activities in the functions.	To supervise personnel in graphics unit. To improve communications between technicians and artists. To staff projects
Outcome:	Interpersonal interaction, discussion, supervision, employment, and personal development.	To evaluate work performed. To encourage discussion. To supervise the repairperson.
Activity:	Discussing with and speaking to other people.	Negotiates with personnel department. Questions applicants. Talks with new employees.

CHAPTER II

Educational Technology: Theoretical Construct, Field, Profession

When we think of educational technology, we can think of it in three different ways—as a theoretical construct, as a field, and as a profession. Consequently, when we define educational technology, we can define it in these same three different ways.

Before stating a definition, then, it is prudent to analyze each of these ways of looking at educational technology, to decide which we are to define, and to set forth criteria by which we can evaluate whether our definition actually defines educational technology in the desired ways.

THREE PERSPECTIVES OF EDUCATIONAL TECHNOLOGY

The first way we can think of educational technology is as a *theoretical construct*—an abstraction which includes sets of ideas and principles about how education and instruction should be carried out through the use of technology.

Second, we can think of educational technology as a *field of endeavor*—the application of the theoretical ideas and principles to solve actual problems in education and instruction. The field includes the techniques used, the activities performed, the information and resources used, and the clients served by practitioners in the field.

Third, we can think of educational technology as a *profession*—a special group of practitioners who are organized, who meet certain criteria, who have certain duties, and who combine to structure a particular part of the field.

None of the foregoing perspectives is more correct or better than the others. Each is a different way of thinking about the same thing. Different people have different perspectives and individuals' perspectives may change, depending upon what they "do" in relation to educational technology.

DEFINING EDUCATIONAL TECHNOLOGY

Which of these three perspectives of educational technology should be used as the basis for the definition?

Thinking of educational technology as a theoretical construct provides the most substantial basis for a definition. We can consider it in the abstract, analyzing, identifying, and defining its elements and interrelationships, then synthesizing them into a cohesive entity. Such a definition would be the most clear and comprehensive definition which could be generated.

Most people, however, think of educational technology as a field, and identify it not by its theory but rather by those tangible elements they can observe. Those who work to apply educational technology generally relate it to the jobs and the activities they perform daily. To them it is not a theory but an entity in which they exist. A definition of the field of educational technology would most closely fit the perceptions of those who work within it.

A still smaller group of people think of educational technology as a profession, and identify it by the special criteria for professions. While these people are concerned with the jobs and activities of the field, they are also concerned with the criteria (such as training, belonging to an organization) which make them "professionals" and which make educational technology their "professional home." A definition of the profession of educational technology would address itself more to the question of "who is an educational technologist?"

To select any single viewpoint to the exclusion of the others as the basis for the definition would limit both the scope and utility of the definition.

Therefore, the definition of educational technology presented here will define educational technology from all three perspectives. It will define educational technology as a theoretical construct—showing the ideas and principles and how they are synthesized into a cohesive entity; as a field—showing its applications in and implications for the real world; and as a profession—identifying the criteria for this special group within the field.

Defining educational technology from all three perspectives is not enough, however, for an adequate definition. In addition, the definition must directly relate these three viewpoints into a coherent whole. To do this, it must make the definitions of the theoretical construct, the field, and the profession *congruent*. The definition must clearly show how the field derives from, and relates to, the theoretical construct, and how the profession derives from and relates to the field. Without such congruence, the definition would be unusable.

REQUIREMENTS FOR THE DEFINITION

To achieve this congruence, and subsequent utility, it is necessary to establish the criteria for defining a theoretical construct, a field, and a profession—requirements which ensure that the definitions interrelate. This is best done by beginning with the most extensive list of requirements—those for defining a profession—and then by identifying which of these requirements are necessary for defining the field, and then a theoretical construct.

These requirements are best spelled out in the list of "Characteristics of a Profession" first identified by Finn and later modified by Finn, AECT, and Silber. They are:

> an organized body of intellectual theory, constantly expanding by research;
>
> an intellectual technique;
>
> an application of that technique to practical affairs;
>
> a long period of training and certification;
>
> a series of standards and a statement of ethics which is enforced (Finn, 1953);

the ability to exercise its own leadership (Finn, 1960a);

an association of members of the profession into a closely knit group with a high quality of communications among members (Finn, 1953);

acknowledgement as profession (Silber, 1974);

professional concern for responsible use of its work;

an established relationship with other professions (AECT, 1972).

The characteristics required for defining a theoretical construct, a field, and a profession are identified in the following sections, along with a more detailed explanation of each characteristic.

DEFINING A THEORETICAL CONSTRUCT

To define educational technology as a theoretical construct, only the first of the above characteristics is required: an organized body of intellectual theory, constantly expanding by research. According to Finn (1953, p. 8):

> . . . the most fundamental and most important characteristic. . . is that the skills are founded upon a body of intellectual theory and research. Furthermore, this systematic theory is constantly being expanded by research and thinking within the profession. As Whitehead says, ". . . the practice of a profession cannot be disjoined from its theoretical understanding or *vice versa* . . . . The antithesis to a profession is an avocation based on customary activities and modified by the trial and error of individual practice. Such an avocation is a Craft . . . ." (Smith *et al.*, 1951, p. 557)

If the definition of educational technology is to meet this requirement, it must meet the requirements for a theory.

Definition of Theory. The term "theory," while often used colloquially as an antonym for the terms "practice" or "practical," has a precise meaning:

> 1. a general principle, supported by considerable data, proposed as an explanation of a group of phenomena; a statement of the relations believed to prevail in a comprehensive body of facts (English & English, 1958, p. 551),

2. a principle or set of principles that explain a number of related facts and predict new outcomes based on these facts (Wheeler *et al.*, 1975, p. 638).

Characteristics of a Theory. Based on these definitions, and other writings about theories (Klausmeier & Goodwin, 1966; Heinich, 1970; Arnoult, 1972), the following characteristics of a theory can be identified:

existence of a phenomenon—there must be some extant phenomenon not completely understood in terms of current knowledge;

explanation—a theory provides an explanation of why or how the phenomenon occurs (as opposed to simple confirmation of its existence);

summarizing—a theory summarizes what is already known about relationships among a large body of empirical information, concepts, and generalizations;

orientation—defines and narrows the facts to be studied as well as distinguishing relevant and irrelevant data;

systematizing—provides a scheme by which the relevant phenomena, postulates, and laws are systematized, classified, and interrelated;

gap identification—points out areas which are relevant but which have been ignored or not resolved at the present as well as identifying areas for future study;

generate strategies for research—provides a basis for formulating new hypotheses and carrying out further research based on the explanation;

prediction—goes beyond empiricial data and what is known to enable extrapolation and prediction of new facts and hypotheses that are at present unknown.

If the definition demonstrates the existence of a phenomenon that is not currently understood; explains, summarizes, orients, systematizes, identifies gaps related to the phenomenon; generates strategies for research about it; and makes predictions about it; then the definition meets the requirements for being a theory.

DEFINING A FIELD

> A field is a sphere of activity which "embraces portions of concepts, skills, and procedures from a number of academic disciplines and also from other applied fields and welds them into new applications." (Finn, 1963, p. iv-v, quoting Gerbner)

In order to meet the requirements for defining a field, the definition of educational technology must meet: the requirements for defining educational technology as a theory; two additional characteristics of a field—intellectual techniques and practical application, and the characteristic of uniqueness.

Intellectual Technique. An intellectual technique is the approach used to solve problems—the manner in which an individual searches for solutions. Gagne and Briggs (1975) would call intellectual technique a cognitive strategy—the process that controls internal thinking processes and brings them to bear in certain ways to solve problems. Intellectual technique serves as the bridge between theory and practical application.

Practical Application. Practical application involves making thoughts, ideas, and processes operational. It results in tangible products. For example, a person actually performing a scientific experiment or carrying out the steps of the instructional development process is making a practical application of intellectual technique.

In addition, practical application indicates how the intellectual technique is to be put into operation in the context of the organizational structures and institutions in which the field operates.

Uniqueness. Since the definition above indicates that a field welds intellectual techniques and practical applications into new applications, the intellectual technique and practical application identified by the definition must be unique to the field. They must be characteristics found in no other field. If the definition leads to a unique intellectual technique and unique practical applications, then the field it defines can be said to be unique.

Thus, the definition of educational technology as a field must first define it as a theoretical construct, then identify an intel-

lectual technique and a practical application, and demonstrate that these are unique to the field of educational technology.

DEFINING A PROFESSION

To define educational technology as a profession, the requirements for defining a theoretical construct and a field must first be met. Then the definition must meet all the other characteristics of a profession.

Training and Certification. Periods of long training are needed to develop specialists and technicians in the profession. There must be some specification of "the nature of the training either through state regulation of some sort or through a system of accrediting training institutions . . . . [Training includes] The nature and content of professional education . . . certification standards, admission standards and practices, and placement." (Finn, 1953, pp. 9, 10)

Standards and Ethics. Statements of ethics indicate how members of the profession should behave. Sets of standards specify guidelines for the materials, devices, and facilities used by people in the profession. "However, the publication of codes of ethics and manuals of standards in itself guarantees nothing. Professionalization occurs when enforcement is possible and vigorous." (Finn, 1953, p. 12)

Leadership. Leadership is necessary to "seize the present and bend the future to proper ends." However, to avoid the circumstance that "many of the recent innovations that are giving us headaches today have been forced upon us from the outside," this leadership must come from within the profession. To exercise its own leadership, the profession must "know our own posture . . . where we want to go and why." (Finn, 1960a, p. 224)

Association and Communication. A strong organization of people in the profession is needed in order to develop and implement the other characteristics—especially standards and ethics, leadership, and training. It is the existence of a strong association which makes possible the "vigorous enforcement" of practices, standards, and ethics.

It is also needed to facilitate communication among members of the profession, communication which "is carried on by meetings, journals of high quality, consultations, and other means." (Finn, 1953, p. 8)

Acknowledgement as a Profession. The members of a profession must believe that there is a profession and that they are members of it. The existence of a profession cannot be mandated or thrust upon practitioners. They must want the profession to exist and acknowledge that it does so. They must acknowledge that they are members of the profession. This acknowledgment is manifested by the formation or existence of an association, by the presence of the other characteristics of a profession, and by public acknowledgment of practitioners that there is a profession of which they are members.

Professional Concern. It is not sufficient that a profession uses its intellectual technique in practical application. Additionally, the profession must be responsible in its use. The profession must be concerned about the uses to which its work is put in society. It must continuously examine the values for which it stands, and, if appropriate, take positions on societal issues affected by its work. (AECT, 1972)

Relationship to Other Professions. There may be more than one profession operating within the field. Each of these professions is related—either explicitly or implicitly—to other professions operating in the field. These relationships must be acknowledged, identified, and developed. (AECT, 1972)

ORGANIZATION OF THE DEFINITION

Since the characteristics provide, in sequence, the requirements for defining a theoretical construct, a field, and a profession, they will be used as the organizing framework for the definition.

The requirement for defining a theoretical construct will be addressed first. Chapter III, "Expanding Theory—Historical Perspectives," will review the past definitions and theories of educational technology. Chapter IV, "Expanding Theory—The Current Theoretical Framework," will present the current definition and theory of educational technology.

The requirements for defining a field will be analyzed next in Chapter V, "Intellectual Technique–Functions, Systematic Application of a Combination of Technologies, Synergistic Effect," and in Chapter VI, "Practical Application–Resources and Functions, Effects on Organizational Structures; Effects on Processes of Education."

The requirements for defining a profession will be addressed in Chapters VII–IX. Training will be considered in Chapter VII, "Certification and Training." Standards and ethics, leadership, association, communications, and acknowledgement as a profession will be discussed in Chapter VIII, "Professional Associations." Finally, the concerned profession and its relationship to other professions will be examined in Chapter IX, "Societal Context–Concerned Profession, Humanism, Relationship to Other Professions."

The concluding chapter will evaluate the definition presented and present conclusions in terms of how well the requirements for defining a theoretical construct, a field, and a profession are met. It will then address the question of who is in the field and the profession.

CHAPTER III

Expanding Theory–Historical Perspectives

INTRODUCTION

> The history of the field of instructional technology is rich in definitions and models of what the field is abou. perhaps too rich at times. Much of the confusion about instructional technology comes from the plethora of definitions. (Wallington, 1974, p. 15)

The definition herein is certainly not the first attempt to address itself to the first characteristic of a profession—theory and research. While previous definitions, models, and theories of educational technology are not adequate for today (Finn, 1953, 1960a; Wallington, 1974), they are nonetheless important for two reasons. First, they show the development of the concepts used in educational technology from its inception. Second, they contain some concepts which are incorporated into, or built upon by, the current definition.

This chapter, therefore, will review the major historical definitions, theories, and models of educational technology. The review will not be exhaustive, as was Saettler (1968), but rather will concentrate on major periods in the history of educational technology, drawing from those periods concepts useful for the current definition.

BEGINNINGS

> Ours is a knowledge generating culture with its birth in the second Industrial Revolution, the age of automation, the age of atomic power. Instructional technology is related to this development and could be thought to have begun in the early 1920's. (Finn, 1967)

> Educational technology is essentially a young field of study. Saettler (1968) traced the philosophical underpinnings of educational technology to the Sophists of the Golden Age of Greece. While such a link may be historically valid and give credence to educational technology as an ancient and venerable field of endeavor, it is not operationally relevant. (Wallington, 1974, p. 15)

This historical overview uses Finn's dating of the 1920's as the beginning of educational technology, and will start with the first formal movement and definition related to educational technology, visual instruction.

VISUAL INSTRUCTION

> A visual aid is any picture, model, object, or device which provides concrete visual experience to the learner for the purpose of (1) introducing, building-up, enriching, or clarifying abstract concepts, (2) developing desirable attitudes, and (3) stimulating further activity on the part of the learner . . . . Visual aids are classified according to general types along a scale of concreteness and abstraction. (Hoban, Hoban, and Zisman, 1937, pp. 9-10)

> This was the first comprehensive textbook in visual instruction and the first to be concerned with the *integration* of visual materials with the school curriculum. (Saettler, 1968, p. 153, about Dorris, Anna V., *Visual Instruction in the Public Schools.* 1928; italics added)

The visual instruction movement was based on the concept of using visual materials to make more concrete the abstract ideas being taught. In addition to the concept of "concreteness," the visual instruction movement introduced two other concepts which are still useful.

First, it introduced the idea of classifying, rather than listing, the types of "visual aids." Second, it emphasized the need to integrate the visual materials with the curriculum, rather than using them in isolation.

One of the movement's weak points, however, was its emphasis on the materials themselves, with a lack of emphasis on the design, development, production, evaluation, and management of the materials. This is not to say that these activities were not considered—merely that they were of secondary importance to the main focus, the materials themselves. Another weakness was that it saw visual materials as an "aid" to the reader rather than as providing units of instruction by themselves.

While most of the research carried out by the visual instruction movement dealt with surveys of equipment, materials, and teacher training (see Saettler, 1968) at least one study (Judd, 1923) attempted to assess the effectiveness of utilizing visual aids.

> Much work needs to be done in educational experimentation and research having for its purpose the discovery and development of the best methods for using motion pictures in teaching. (p. 8)

With the advent of sound recording and sound motion pictures, the visual instruction movement expanded to include sound.

FROM VISUAL INSTRUCTION TO AUDIOVISUAL INSTRUCTION

> In a technical sense *audio-visual instruction* is a term used to designate an extensive variety of devices . . . which are used by teachers to transmit ideas and experiences through the eye and the ear . . . . The chief distinction between audio-visual instruction and other forms of instructional technique is a matter of emphasis. *Audio-visual instruction* emphasizes the value of concrete or non-verbal experience in the learning process, whereas other forms of instruction stress verbal or symbolic experience . . . . *Audio-visual instruction should not be regarded as a method of teaching.* Audio-visual materials are of value only when used as an integral part of the instructional process. (McClusky, 1949, p. 6)

> Audiovisual materials and devices should not be classified exclusively as "eye" and "ear" experiences. They are modern technological means of providing rich, concrete experiences for students. (Dale, Finn, and Hoban, 1949, p. 253)

While the audiovisual instruction movement added the "audio" component to the materials of the visual instruction

movement, it added little conceptually. It kept the notions of the abstract-concrete continuum (with audiovisual materials at the more concrete end) and of classifying, rather than listing, types of materials. These concepts were put into their most concrete form in the Cone of Experience (Dale, 1954). It also continued to emphasize the idea that audiovisual materials needed to be integrated into the curriculum.

The audiovisual instruction concept also continued the two basic weaknesses of the movement from which it evolved. It was more concerned with the materials than with the processes of developing them, and it continued to view audiovisual materials as aids to teachers' instruction.

There was, however, a good deal of research conducted regarding the effectiveness of audiovisual materials and about which types of materials worked "best" (Hoban and van Ormer, 1950; Dale, Finn, and Hoban, 1949).

By the end of World War II, a new trend had begun in the audiovisual field—a change of perspective from audiovisual to two parallel new conceptual frameworks, communications theory and early systems concepts.

FROM AUDIOVISUAL INSTRUCTION TO COMMUNICATIONS

> A fruitful approach to better understanding and greater efficiency in the audiovisual field seems to lie in the concept of *communications.* (Hoban, 1956, p. 9)

> . . . We are concerned with communication; we are interested in the answer to the question, "What does it mean to communicate?"
>
> As I think about the effectiveness of audio-visual materials, I find that reading and thinking about communications are one of my most fruitful methods of evaluation. In short, I ask myself: "What broad theories of communication can I operate under which will be most helpful to me . . . ." (Dale, 1953, p. 3)

The communications orientation to educational technology altered the theoretical framework of the field. Instead of concentrating on the "things" of the field, it concentrated on the entire process of communicating information from a source (either a teacher or some materials) to a receiver (the learner).

In order to describe this entire process, the communications orientation added a second concept applicable to the current

definition—the use of dynamic models. While Dale's Cone of Experience was, in a sense, a model, it was still a static description of instructional techniques along a single dimension. The models created by communication theorists were dynamic models of a process—indicating the elements involved and the interrelationships among them—and included more than the materials used to transmit the message.

While many models of the communication process were developed (see Ball and Byrnes, 1960), the S-M-C-R Model (Berlo, 1960) is perhaps the simplest and the most useful for generating concepts related to educational technology. The model is shown in Figure 3.1.

S	M	C	R
SOURCE	MESSAGE	CHANNEL	RECEIVER
Comm. Skills	Content	Seeing	Comm. Skills
Attitudes	Elements	Hearing	Attitudes
Knowledge	Treatment	Touching	Knowledge
Soc. System	Structure	Smelling	Soc. System
Culture	Code	Tasting	Culture

Figure 3.1
A MODEL OF THE INGREDIENTS IN COMMUNICATION*

This model demonstrates the two concepts indicated above. It concerns itself with the entire process of transmitting a message from a source to a receiver and it indicates the elements involved in the process and their dynamic interrelationships. In addition, the model's elements bring to light several other important concepts.

*From *The Process of Communication: An Introduction to Theory and Practice* by David K. Berlo. Copyright (c) 1960 by Holt, Rinehart and Winston, Inc. Reprinted by permission of Holt, Rinehart and Winston.

The learner (receiver) and the teacher or materials (source) are integral parts of educational technology seen as communications. They are not seen as being outside the concerns of the field.

The content of the message, as well as its structure and treatment, are seen as part of the communication process, and, hence, as part of educational technology.

Five senses are seen as part of the communication process, a concept more inclusive than the "eye-and-ear" experiences of the audiovisual movement.

All types of messages using all types of codes (verbal, symbolic, tactile as well as the concrete codes of the audiovisual movement) are seen as part of the communication process, and, hence, as part of educational technology.

Though the model appears linear in fashion, communication situations are seldom one-way. They occur in both directions. Other more complex models—notably the Wesley-MacLean (1957) and the Berlo Interpreter (1960) models—formalize this notion by adding to the model an element called feedback. Feedback is information sent back to the source by the receiver indicating his/her responses to the message.

In addition to these seven concepts, the communications orientation provided educational technology with a significant body of research (see Ball and Byrnes, 1960) related to the elements and their interrelationships in the communication process.

While the transition from audiovisual instruction to communications was occurring, a separate, but somewhat related, transition was occurring in parallel.

FROM AUDIOVISUAL INSTRUCTION TO EARLY SYSTEMS CONCEPTS

> A system can be defined as an arrangement of components with a common purpose. The importance of the system concept is in the notion of (a) components in a system; (b) the integration of these components, and (c) the increase in system efficiency . . . . (Hoban, 1960, p. 110)

> The concept of programming and the systems and systems analysis it implies completely absorbs the ideas of materials. Instructional materials becomes an outmoded, atomistic, pre-technological concept useful mainly to the historians of education. (Finn, 1960b, p. 18)

The early systems concepts of educational technology regarded systems as products—not isolated products as in the audio-visual materials conception, but rather as complete products arranged and integrated in a manner which allowed them to provide complete instruction.

Most indicative of this product-oriented early system concept was the notion of combining mass and individual instruction with conventional instruction into an instructional system using a "black box" concept.

> If . . . the instructional process can be broken down into the elements of (a) mass presentation techniques; (b) individual automated teaching; (c) human interaction; (d) individual study; and (e) creative periods, then . . . these elements would be treated as black boxes in an instructional system. For each instructional problem . . . [we] would create the proper system designed to achieve the agreed upon objectives. (Finn, 1961, p. 37)

The Instructional Systems—Black Box Concept (Finn, 1961, p. 36) is shown in Figure 3.2.

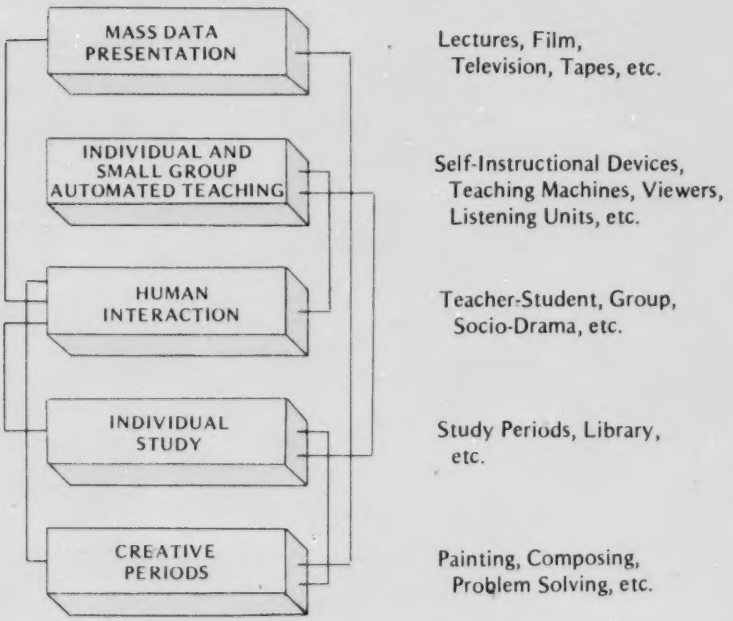
MASS DATA PRESENTATION
Lectures, Film, Television, Tapes, etc.
INDIVIDUAL AND SMALL GROUP AUTOMATED TEACHING
Self-Instructional Devices, Teaching Machines, Viewers, Listening Units, etc.
HUMAN INTERACTION
Teacher-Student, Group, Socio-Drama, etc.
INDIVIDUAL STUDY
Study Periods, Library, etc.
CREATIVE PERIODS
Painting, Composing, Problem Solving, etc.

Figure 3.2
INSTRUCTIONAL SYSTEMS—BLACK BOX CONCEPT

This early systems concept of educational technology introduced several important new concepts to the field. First, it stressed that the basic unit, or product, of the field was not individual materials but rather complete instructional systems. A second, related concept was that individual materials were seen as components of an instructional system, not as isolated aids to the teacher's instruction.

Third, it indicated that instructional systems did not come into existence without cause. The integration of the components to make up a system had to be in some way designed. Further, it was not sufficient to say that materials should be somehow integrated into the curriculum. Systems concepts specified that the nature of that integration be based on instructional problems and objectives. Thus, in an instructional system, materials were to be designed as components for systematic use in a specified instructional situation.

These two new views of educational technology—communications and early systems concepts—were not separate for long.

AUDIOVISUAL COMMUNICATIONS: SYNTHESIZING COMMUNICATIONS AND EARLY SYSTEMS CONCEPTS

> *Audiovisual communications is that branch of educational theory and practice concerned primarily with the design and use of messages which control the learning process.*
>
> It undertakes: (a) the study of the unique and relative strengths of both pictorial and non-representational messages which may be employed in the learning process for any purpose; and (b) the structuring and systematizing of messages by men and instruments in an educational environment. These undertakings include the planning, production, selection, management and utilization of both components and entire instructional systems.
>
> Its practical goal is the efficient utilization of every method and medium of communication which can contribute to the development of the learner's full potential. (Ely, 1963, 18-19)

This definition, the official definition of the field by DAVI in 1963, represented a major paradigm change (Kuhn, 1962) for educational technology—from an emphasis on audiovisual materials as aids providing concrete experience to an emphasis on the complete process of communication and the use of complete systems of instruction.

By completely altering the theoretical framework of the field, this definition and its supporting theory and models, provided new concepts for educational technology which are important to the current definition.

It replaced the "things, senses, concreteness" orientation of the field with a process concept. "The concept of process dictates the relationship between events as dynamic and continuous . . . . All elements in a process interact with each element, affecting all the others" (Ely, 1963, p. 19). In addition, this statement includes the seeds of systems-as-process concepts (to be discussed later).

It concluded that "learning theory and communication theory offer the basic concepts for a definition of the instructional technology field," (Ely, 1963, p. 20) and that "in view of a systems approach, the task of the audiovisual specialist may be described as . . . design of a presentation which utilizes . . . elements . . . . The appropriate combination of these elements implies a systems approach" (Ely, 1963, p. 24). Thus, the audiovisual communications synthesized the concepts of communications, systems, elements or components of a system, and design of a system (all discussed in the previous two sections) and the concept of learning theory (to be discussed later).

It developed a model which combined the process orientation of communication and learning theory with the system-as-product orientation. Ely (1963) termed this "AV relationships to the educational-communication process" (pp. 24-25).[1] The model is shown in Figure 3.3. The model synthesizes many concepts already discussed related to communications and systems, and adds some new concepts.

The model re-emphasizes that the learner is an integral part of the process of educational technology and brings in concepts from learning theory by adding to the communication model the elements of response by the learner and evaluation of that response. It also re-emphasizes, and formally indicates in the model, the communications concept of feedback—both to the

[1]It should be noted that the model, the elements in a system and their definitions, and the notions of systems used in the 1963 *Glossary* are based on the work done by Eboch, 1962.

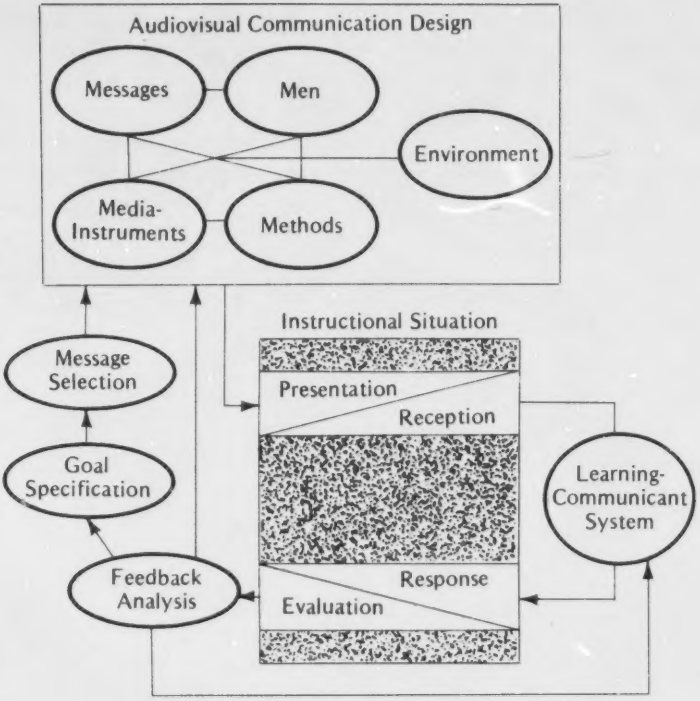

Figure 3.3
AV RELATIONSHIPS
TO EDUCATIONAL-COMMUNICATION PROCESS

source and the learner—regarding the learner's response. The model shows graphically both the two-way nature of communications, something merely implied in some communication models, as well as the dynamic, continuous, and interactive nature of the audiovisual communication process.

The model also went beyond stating that there were components of an instructional system. It identified and defined specific components:

Messages are the information to be transmitted—the content, the meaning.

Media-Instrumentation indicates the transmission systems

(the materials and devices) available for carrying the selected messages.

Men indicates the personnel required to control or assist in the information-transmission or the presentation.

Methods are the specifications and techniques required for effective presentations.

Environment indicates the controls or requirements of the given conditions within the instructional situation. (Ely, 1963, p. 24)

The model and its list of elements reemphasized several prior concepts, such as:

there are components within a system;

the components can be classified by type, rather than listing each individual component;

the message itself is an important component which must be included in the design of audiovisual communication, and;

people, as well as materials, must be included as components of the system.

The model also added two newer concepts:

the methods of utilizing "media-instruments" are important and must be considered as components of the system, and;

the environment in which the "media-instruments" are used affects the presentation and response, and therefore must also be considered as a component of the system.

The definition (though not the model) introduced the concept that certain activities must be performed in order to "design" systems. For the first time, the conceptual definition was related "to personnel who serve within the broad area of instructional technology" (Ely, 1963, p. 27). The definition statement called the activities performed, "Functions of Personnel Within the Field," thus introducing the notion of functions. (See also Morris, 1963.) The definition statement identified and explained several of the functions, such as: distribution, production, consultation, management, application of functions, and evaluation. Other functions, previously identified

(Hoban, 1956) but not included in the definition statement, were content organization and utilization.

While this definition, and its implications, represented a major paradigm change for educational technology and synthesized most of the concepts that had evolved from previous orientations, as well as introducing many new concepts to the field, it was not without its weaknesses.

The most noticeable weakness is its inconsistent use of names for the field. It used almost interchangeably the terms "audiovisual communications," "audiovisual," "educational communications," and "instructional technology." This created confusion about the actual name of the field—a confusion which persisted for many years (see the March, 1965 issue of *Audiovisual Instruction*).

The most important weakness, however, was on a more basic conceptual level. The definition contained the beginnings of the "systems-as-process" or "systems approach" concept. However, the definition did not appear to understand, use, or integrate the complete notion of the systems approach. This is evidenced by two problems in the definition. First, the model—offering the elements of a system and combining it with a communications model—and the functions of personnel in the field—necessary to implement the model—are seen and presented as separate concepts. They are never integrated to show how one relates to the other—an imperative in a true systems approach. Second, not all the elements of a systems approach are included as part of the "audiovisual communication design subsystem," *i.e., ". . . Message selection occurs outside the context of the audiovisual design system"* as do goal specification and feedback analysis (Ely, 1963, p. 25). In a true systems approach, all elements would be included within the system. These weaknesses were to be corrected by the next theoretical framework for educational technology—a systems approach to education.

Before examining this change, however, it is necessary to consider another field which developed simultaneously with educational technology—a field which generated concepts applicable to educational technology at this point in its conceptual development. The field was behavioral sciences.

INFLUENCE OF THE BEHAVIORAL SCIENCES

> From this prospect of an advancing science of learning, it is a shock to turn to that branch of technology which is most directly concerned with the learning process—education . . . . We are on the threshold of an exciting and revolutionary period, in which the scientific study of man will be put to work in man's best interest. Education must play its part. It must accept the fact that a sweeping revision of educational practices is possible and inevitable. (Skinner, 1954, reprinted in Skinner, 1968)

> . . . the science of behavior, especially learning theory, [serves] as a primary "underlying science" from which applications to a technology of instruction might be anticipated. (Lumsdaine, 1964, p. 373)

> Instructional technology is the application of behavioral technology to the systematic production of specified behaviors for instructional purposes. . . . (Deterline, 1965, p. 407)

The behavioral science input to instructional technology, while having its origins in early learning theories, began to have an impact on the field with Skinner's notions of reinforcement and their applications in programed instruction and teaching machines. The growth of concepts within the behavioral sciences is as long and complex as the growth of concepts within educational technology. It is not possible, therefore, to give a complete history of the behavioral sciences here. Rather, the focus will be upon several major conceptual contributions the behavioral sciences have made upon educational technology.

Shift from stimuli to behavior and reinforcement

> So far as we are concerned here, teaching is simply the arrangement of contingencies of reinforcement . . . . Three variables compose the so-called contingencies of reinforcement under which learning takes place: (1) an occasion under which the behavior occurs, (2) the behavior itself, and (3) the consequences of the behavior. (Skinner, 1968, pp. 4, 5)

The theoretical framework of the audiovisual communications view of educational technology (cf. Figure 3.3) places heavy emphasis on the stimuli, or messages, transmitted to the learner. It makes only passing reference to the fact that there is a response from the learner and feedback to the learner about the response. Skinner's notion of behavioral science reverses this emphasis.

It adds the concept that the learner's behavior, and the consequences or reinforcement of that behavior, are the key elements in learning.

The emphasis on behavior and reinforcement, as opposed to stimuli, raises the question of how the behavior is to be elicited and reinforced.

Use of Devices

> These requirements are not excessive, but they are probably incompatible with the current realities of the classroom . . . . We have every reason to expect, therefore, that the most effective control of human learning will require instrumental aid. The simple fact is that, as a mere reinforcing mechanism, the teacher is out of date. (Skinner, 1954, reprinted in Skinner, 1968, pp. 21-22)

Behavioral science, then, adds the concept that devices are required, but that their purpose changes from presentation to reinforcement. Also, the devices can, and must, take the place of the teacher for certain purposes.

The question then becomes one of the types and characteristics of devices needed for this new purpose.

From presentation materials to teaching machines and programed instruction

> Audio-visual aids supplement and may even supplant lectures, demonstrations and textbooks. In doing so, they serve one function of the teacher: they present material to the student . . . . There is another function to which they contribute little or nothing (Skinner, 1968, pp. 29-30). . . . to generate specific forms of behavior these things must be related to the student's behavior in special ways. The principles on which his teaching machines were based are:
>
> 1) reinforce the student's responses frequently and immediately
> 2) provide for the student to be in control of his learning rate
> 3) make sure he follows a coherent, controlled sequence
> 4) require participation through responding. (Hawkridge, 1976, p. 15)

Skinner's teaching machines, and the ensuing programed instruction movement, were direct applications of the concept that devices and materials must do more than present information—they must be related to the student's behavior. The

specific relationships include: responding by the student, controlled sequence, frequent and immediate reinforcement, and individual learning rate. By doing these things, the devices and materials can manage the contingencies of reinforcement and thereby ensure learning.

Behavioral objectives

> [Behavioral objectives] First, identify the terminal behavior by name . . . [and] specify the kind of behavior which we will accept as evidence that the learner has achieved the objective. Second, try to further define the desired behavior by describing the important conditions under which the behavior will be expected to occur. Third, specify the criteria of acceptable performance by describing how well the learner must perform to be considered acceptable. (Mager, 1962, p. 12)

The main concept provided by behavioral objectives was an emphasis on the learner's behavior and the conditions under which it would occur. This further extended the communications theory idea of the learner as a part of the process by detailing the learner's role.

Further, behavioral objectives should be stated before instruction was developed. This notion was widely accepted and applied to presentation materials and traditional teaching, as well as to Skinner's "contingency management" techniques. It also formed one of the bases for the later systems approaches (to be discussed later).

Finally, behavioral objectives provided the basis for a different type of evaluation of learning.

Criterion-referenced evaluation

> Measures cast in terms of such criterion standards [*i.e.*, behaviorally defined objectives] provide information as to the degree of competency obtained by a particular student which is independent of reference to the performance of others. (Glaser, 1965, p. 801)

Criterion-referenced evaluation held that evaluation of learners ought to be based upon the degree to which they attained the behaviors specified in the objectives, rather than on how they compared to other students. It made clear the concept that

the evaluation (and therefore instruction) ought to be based on objectives, and not extraneous content. Finally, this implies that evaluation measures, like behavioral objectives, should be stated before the instruction is developed.

Behavioral objectives and criterion-referenced evaluation made better programed instruction possible. More important, they served to move programed instruction beyond small segments of instruction.

Programing the school

> [Schools] have tended to adopt programed materials instead of the principles of programed instruction . . . programed instruction must be applied more inclusively to the development of the entire school curriculum, its materials, media, and personnel (217)
>
> . . . programing is a general process for developing an instructional sequence . . . (226) [and] will involve . . . the development and adoption of some total plan that employs some sound learning principles and is subjected to careful and continuous study and analysis. It will involve the development of a technology of instruction (226)
>
> . . . It will be necessary to "program" the *entire* school curriculum (230). (Lindvall and Bolvin, 1967, pp. 217-254)

The thought that the entire instructional program of a school—as opposed to isolated instances of instruction—should be "programed" to meet Skinner's principles represented a quantum leap forward for the programed instruction, and hence behavioral technology, movement.

It introduced (or, at least, updated) the concept of individualized and self-instruction for entire courses, based on behavioral objectives, using programed materials, and with criterion-referenced evaluation.

This was coupled with the concept that the management of the instructional process must be congruent with the characteristics of that process—that is, that self-paced, individualized, and machine-based instruction were not appropriate within a school organized and managed for group-paced, group-based, teacher based instruction. It raised a significant question. How were the individualized materials, which formed the backbone of the new process, to be developed?

Programing as a developmental process

> The uniqueness and strength of programed instruction lies mainly in its production process. Unfortunately, this process is not evident in programed materials or environments, although the process has determined their structure and quality. Programed instruction is developed through a process which has empirical and analytic qualities. (Lange, 1967, p. 57)

Another insight into the behavioral technology theoretical framework was this realization that, while programed instructional materials must contain certain elements to "manage the contingencies of reinforcement," the programed materials themselves were not the totality of programed instruction.

There was also a significant developmental process in producing programed materials to make them effective instructional tools. The process synthesized many of the concepts previously discussed into a series of steps which provide a model for the development of programed instruction. The model is shown in Figure 3.4.

This sequence reemphasizes behavioral objectives, criterion-referenced evaluation, and behavioral analysis and also adds the concept of testing the program before it is released for general use. The program is then revised based on the test results.

This approach to programed instruction provides a model for developing instruction—a model quickly assimilated into educational technology.

FROM AUDIOVISUAL COMMUNICATIONS TO THE SYSTEMS APPROACH AND INSTRUCTIONAL DEVELOPMENT

> More recent thinking conceives of educational technology as a systems approach to the teaching learning process which centers around the optimal design, implementation, and evaluation of teaching and learning as such. (Hinst, 1971, p. 41)

> The second and less familiar definition of instructional technology goes beyond any particular medium or device. In this sense, instructional technology is more than the sum of its parts. It is a systematic way of designing, carrying out, and evaluating the total

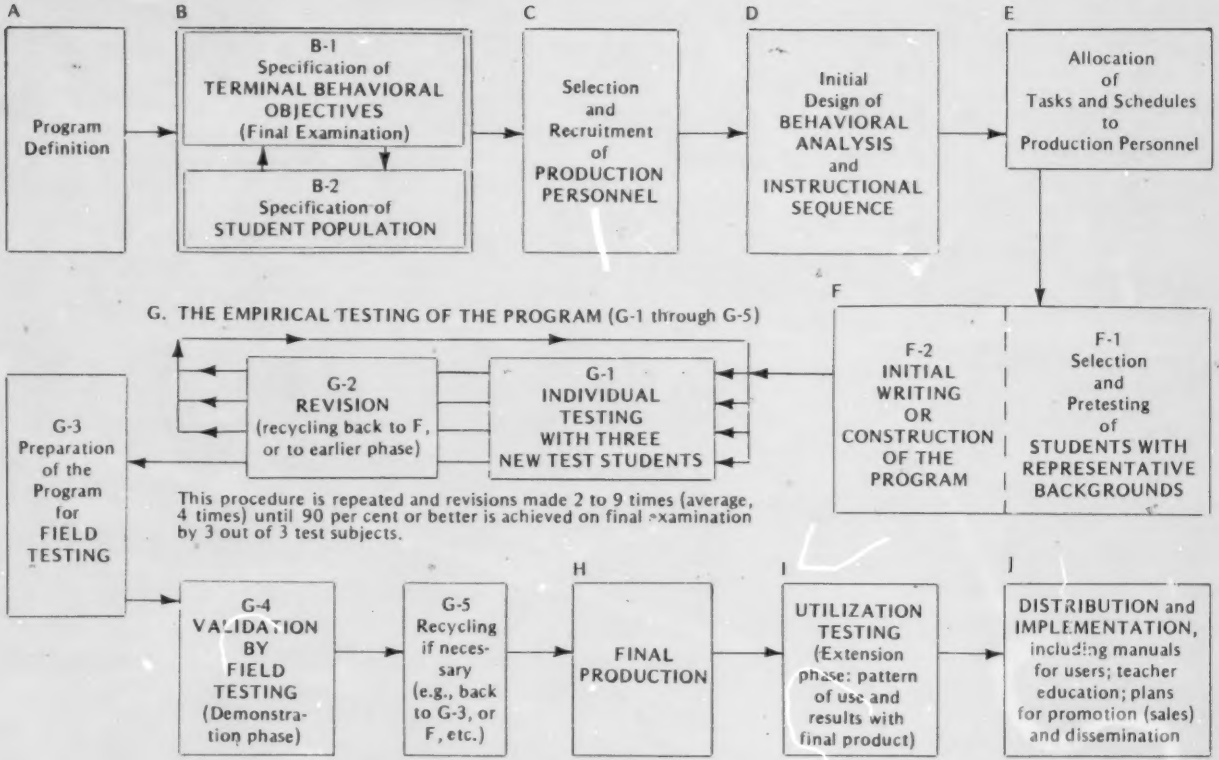
A
Program Definition
B
B-1 Specification of TERMINAL BEHAVIORAL OBJECTIVES (Final Examination)
B-2 Specification of STUDENT POPULATION
C
Selection and Recruitment of PRODUCTION PERSONNEL
D
Initial Design of BEHAVIORAL ANALYSIS and INSTRUCTIONAL SEQUENCE
E
Allocation of Tasks and Schedules to Production Personnel
F
F-1 Selection and Pretesting of STUDENTS WITH REPRESENTATIVE BACKGROUNDS
F-2 INITIAL WRITING OR CONSTRUCTION OF THE PROGRAM
G. THE EMPIRICAL TESTING OF THE PROGRAM (G-1 through G-5)
G-1 INDIVIDUAL TESTING WITH THREE NEW TEST STUDENTS
G-2 REVISION (recycling back to F, or to earlier phase)
G-3 Preparation of the Program for FIELD TESTING
This procedure is repeated and revisions made 2 to 9 times (average, 4 times) until 90 per cent or better is achieved on final examination by 3 out of 3 test subjects.
G-4 VALIDATION BY FIELD TESTING (Demonstration phase)
G-5 Recycling if necessary (e.g., back to G-3, or F, etc.)
H
FINAL PRODUCTION
I
UTILIZATION TESTING (Extension phase: pattern of use and results with final product)
J
DISTRIBUTION and IMPLEMENTATION, including manuals for users; teacher education; plans for promotion (sales) and dissemination

Figure 3.4
A GENERALIZED FLOW CHART OF PROGRAM DEVELOPMENT

UU 61

> process of learning and teaching in terms of specific objectives based on human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction. (Commission on Instructional Technology, 1970, p. 21)

While the report of the President's Commission has been widely criticized (see Snider, 1971), it contained many concepts relevant to the present definition.

It posits educational technology as process, rather than as media or devices—thus reinforcing the concepts from communications theory and programed instruction.

It specifies that educational technology uses a systems approach to instruction, stressing process rather than product—a departure from earlier systems thinking. The systems approach now required the

> . . . examination of a process as an entity with cognizance of the relationships involved in and among all components. It starts with specification of objectives, proceeds through the necessary operations, and evaluates the end product in terms of these objectives and modifies the system if found wanting. (Heinich, 1965, p. 4)

It is essentially the same as the process used for developing programed instruction.

It indicated that educational technology is based on both learning and communication theory, thus supporting the position of the 1963 DAVI definition statement and incorporating the principles derived from the behavioral sciences.

It saw educational technology as making use of both human and nonhuman resources—re-emphasizing that people are part of educational technology.

It viewed the products of educational technology as resources that could be used to improve instruction. This is the first official use of the term "resources" to describe the products of educational technology.

In using the terms "designing," "carrying out," and "evaluating," it again stressed the notion that there were certain functions which had to be carried out by personnel within the field of educational technology.

It introduced the concept that educational technology is "more than the sum of its parts"—that by combining all the functions and resources in the systematic process, something new and different was created that went beyond what could be expected from any of these elements applied separately. This phenomenon is referred to as "synergism."

The systems approach to designing instruction was carried a step further by the instructional development movement, which synthesized these concepts with those from the behavioral sciences to create a formalized approach to how instruction is technology developed within educational technology.

There are few complete formal definitions of instructional development. The following synthesis (AECT, 1977) gives the flavor of its theoretical framework:

> A systematic approach to the design, production, evaluation, and utilization of complete systems of instruction, including all appropriate components and a management pattern for using them; instructional development is larger than instructional product development, which is concerned with only isolated products, and is larger than instructional design, which is only one part of instructional development. (D & T Committee)

The systematic process of developing instruction is usually presented in the form of a model. Though there is no single universally accepted model, the model in Figure 3.5 (according to Wittich and Schuller, 1973) contains the elements and sequence within which most other models can fit.

The theoretical framework of instructional development serves to synthesize and formalize many of the concepts already discussed: process, systems approach, functions. It is also helpful in expanding and indicating some relationships among: behavioral objectives, criterion-referenced tests, use of appropriate human and nonhuman resources, appropriate use of individualized and self-instruction, development of complete instructional systems, emphasis on the learner, evaluation and revision of the instructional system and products based on tryouts with learners, and systematic management—all key elements in applying technology to instruction.

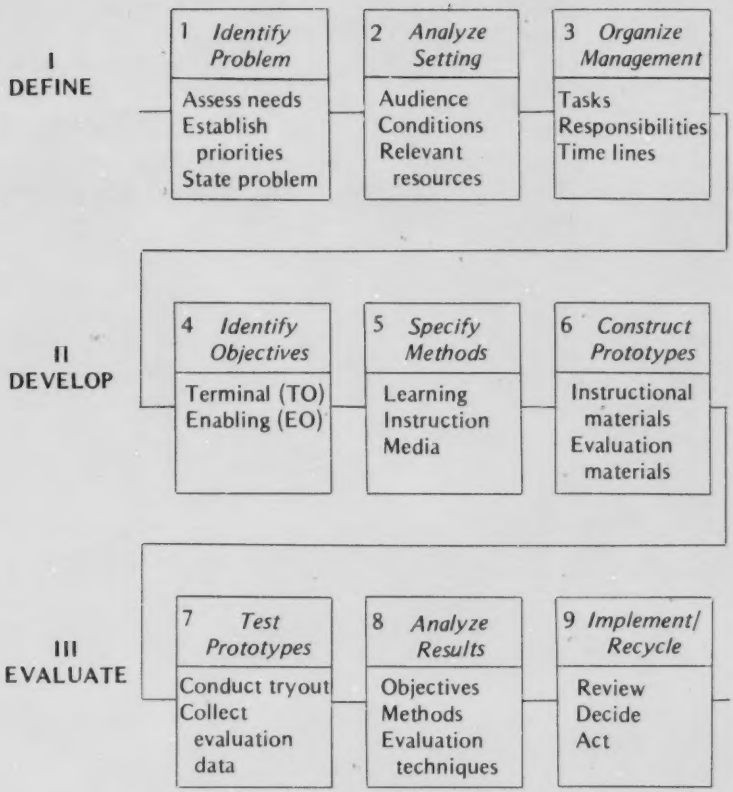

Figure 3.5
INSTRUCTIONAL DEVELOPMENT SYSTEM

The Instructional Development Model shown here was developed between 1969-71 by the University Consortium for Instructional Development and Technology (UCIDT) under a contract with the USOE as part of the Instructional Development Institute (IDI) program. IDIs have been given in over 350 U.S. school systems and in Iran and in the Philippines. UCIDT consists of Instructional Development and Technology Departments in the following universities: Indiana, Michigan State, Syracuse, U.S. International University in San Diego, and Southern California where the National Office is located.

However, the systems approach theoretical framework of the President's Commission and instructional development still does not provide an adequate definition of educational technology. First, it does not deal with the total educational—or even instructional—process. For example, it omits the determination of curriculum, the functions involved in distributing and using instructional systems once they are developed, and the activities involved in applying technology to the non-instructional parts of education.

Second, it accepts current institutional and organizational constraints placed upon the design of instruction (the problem noted earlier by Lindvall and Bolvin), rather than questioning and revising them to fit the new instructional systems.

Third, it is less specific than the 1963 DAVI definition about the types of resources which could be used as well as the direct interaction (communication) between the learner and the source of the messages (resources).

Fourth, while it is indeed based on a body of theory and research, there is no provision within the definition or the model for generating or testing new theory.

Finally, it is not connected to the realities—both problems and promises—of Galbraith's (1967) "post-industrial society."

FROM AUDIOVISUAL COMMUNICATIONS AND SYSTEMS APPROACHES TO INSTRUCTIONAL TECHNOLOGY

> Technology is *not* just machines and men. It is a complex integrated organization of men and machines, of ideas, of procedures, and of management . . . the term "educational technology" *expands* the areas of theoretical development, research and implementation in education. (Hoban, 1965, p. 124)

. . . instructional technology, in its modern usage, involves the *management* of ideas, procedures, money, machines, and people in the instructional process. As such, it involves:

(1) a physical device(s) which mediates information transmission;
(2) a system of instruction of which this device(s) is one of several components; and
(3) a range of mediating options involving progression in (a) requirements for physical alteration of the "classroom"; (b) remoteness in time and space between the tutor-planner and the student;

> (c) sophistication of design of programmed information exchange between the "tutor" and the student; (d) complexity and cost of hardware; (e) level of technical skills required for equipment construction, installation, "de-bugging," operation and maintenance; (f) independence from classroom teacher control or continuous monitoring in the operation of the device-centered teaching; (g) additional manpower required by way of paraprofessional personnel for the use of instructional technology, and (h) role changes and new skills required of "classroom" teachers in (I) management of technology, and (II) other and/or new non-structured, non-mediated teaching activities essential to personality development, humanistic growth, and cultivation of values, all of which lie outside the present and forseeable potential of instructional technology as herein considered. (Hoban, 1965, p. 124)

The theoretical framework of instructional technology represents the second major paradigm change (Kuhn, 1962) for educational technology. It brings a whole new outlook to how educational technology fits together and is related to society.

The needs for, and causes of, this paradigm change in viewing the field and its relation to society were identified by Finn (1955, 1960b, 1964b, 1966, 1968):

the knowledge explosion,

the population explosion,

the second industrial revolution,

the long revolution (including democratic, industrial-scientific, and cultural revolutions),

the need to re-make the public philosophy to fit the times,

the introduction of technology on a large scale in society in general,

the need to ensure an adequate supply of scientists to operate the technological society,

the need for general education of all citizens about technology,

the need to rapidly retrain people displaced by automation,

the inevitable extension of technology in general society into the instructional process.

The growth of instructional technology to the point where it could serve as a theoretical framework for the field is shown in Figure 3.6.

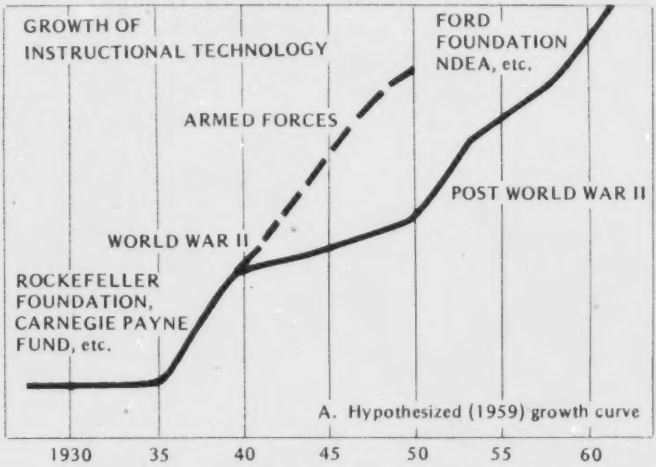

Figure 3.6
GROWTH OF INSTRUCTIONAL TECHNOLOGY
(Finn, 1961)

This growth follows Rostow's (1960) 5 stages of the growth from a traditional society to a high-order technological culture:

1. *traditional society*—science and technology are not available or regularly and systematically applied;

2. *preconditions to take-off*—there are psychological and political changes in society which make people and institutions receptive to technology, and there is the building of a necessary level of capital overhead in society;

3. *take-off*—the critical mass of the preconditions is reached, and some technological innovation occurs acts as a sharp stimulus to technological thinking;

4. *drive to maturity*—there are more refined and complex technological processes used, and society's investment in tools is 10-20%;

5. *high mass consumption*—society applies technological processes and resources anywhere it chooses.

Finn (1960c) believed that machines, which he viewed as the symbols of technology, and the societal changes cited above represented the "preconditions to take-off" stage for instructional technology, and that "the educational culture is in take-off." (p. 70)

The framework for instructional technology introduces the concept of complex, integrated organization—more than only process, or only people, or only machines, and even more than a simple combination of these. The components making up technology bear complex interactive relationships.

It also identifies those elements within that complex, integrated organization—*i.e.*, people, procedures, ideas, machines—at the same time emphasizing that each is but a single element.

Second, and perhaps most important, it emphasizes the role of management as a major concern of educational technology. *All* of the aforementioned elements must be managed and controlled so the system operates both effectively and efficiently.

The notion of efficiency highlights the third concept contributed by this theoretical framework, finances. Educational technology is concerned with expending money in a way that maximizes the effectiveness of the people, processes, and devices.

Fourth, it refines the concept of "people" as part of the process in two ways. It adds the notion of specialization and differentiation between the levels of work of personnel from aides to professionals. It specifies that personnel will need new skills to operate within the context of educational technology.

Fifth, it expands on Finn's (1961) "black-box concept" by making clear that there can be a remoteness in time and space between the learner and the source of the message and that there are clearly instances where mediated instruction (not involving a classroom teacher) is appropriate, if not preferred or mandated.

This theoretical construct of educational technology does have one particular flaw. It does not explain in detail the nature of the "complex, integrated organization" for these components nor precisely how they fit together.

REFINING EDUCATIONAL TECHNOLOGY

> Educational technology is a field involved in the facilitation of human learning through the systematic identification, development, organization, and utilization of a full range of learning resources, and through the management of these processes . . . . Educational technology can be described by first the materials it uses and then by describing what its practitioners do with them. Specifically, this means describing: 1) the range of resources for learning with which the field deals; 2) the systematic way it identifies, develops, organizes, makes available, and utilizes these resources, *and* the way it manages that process . . . . The description of the field of educational technology is summarized in . . . [the Domain of Educational Technology Model]. (AECT, 1972, pp. 36, 38, 40)

This definition is one of several attempts to describe the complex, integrated process that synthesizes all the concepts. In addition to a verbal description, the definition used a model to describe educational technology. Other efforts attempted this synthesis through studies, definitions, articles, and books, all using this model approach. These efforts are cited in Table 3.1.

While all these efforts were steps in the right direction, there was still a problem. Each used a slightly different "complex, integrated organization" in the model they proposed, and there was some disagreement in the field about which one was the best (see Myers and Cochran, 1972).

TO THE PRESENT DEFINITION

> Somehow, somebody, someday is going to figure out how to put these things together into a fairly useful order of instruction to solve specific problems . . . . Now if this is true, I'll leave you with this question. Who is going to do it? (Finn, 1960c, p. 61)

The definition presented in this document represents what AECT believes is the best refinement and synthesis of educational technology, at this point in time. It draws heavily on all the theoretical frameworks presented in this chapter, and especially on the models which attempted to refine educational technology. While drawing heavily on these past efforts, taking the best elements of each, it does not merely endorse one of these efforts. Rather, it attempts to synthesize them into a

definition and model of educational technology which shows all the elements and concepts of educational technology and their interrelationships in a complete, cohesive, clear, and coherent manner.

Table 3.1
Efforts to Refine Educational Technology

Purpose	Effort	Author(s)	Date
Defining the Field	"What Field Are We In, Anyhow," *Audiovisual Instruction*	Silver	1970
	"The Field of Educational Technology: A Statement of Definition," *Audiovisual Instruction*	AECT	1972
	"Is There a Field of Educational Communications and Technology," *Audiovisual Instruction*	Heinich	1973
	Technology and the Management of Instruction	Heinich	1970
Career Development and Training	*Jobs in Instructional Media (Part I)*	Wallington, *et. al.*	1970
	Jobs in Instructional Media Study	Hyer, *et al.*	1971
	Media Guidelines Study	Hamreus	1970
	Training Programs for Educational Media Technicians	Wallington and Bruce	1972
	Media Personnel in Education	Chisolm and Ely	1976
Collecting Data	*NCES Handbook X: Educational Technology*	AECT for NCES	1975

CHAPTER IV

Expanding Theory– The Current Theoretical Framework

UNDERLYING ASSUMPTIONS AND CONCEPTS

Any conceptual definition is built upon a set of subordinate concepts and has implicit in it a set of underlying assumptions. The definition of educational technology is no exception.

The assumptions upon which the definition of educational technology is based are:

> Modern society is characterized by a high degree of technological sophistication . . . .
>
> A technological culture, by definition, is one that finds technological solutions to its problems . . .
>
> A new technology for instruction has been developed and proved through basic research and practice . . .
>
> The new educational technology is capable of meeting and solving certain of the school's major problems in instruction, organization, and administration.
>
> Application of the new technology will result in major changes affecting the administration, organization and physical facilities of the public schools.
>
> Methods of instruction will be modified to a major degree, particularly in the presentation of information [and management of contingencies of reinforcement].

> Teachers and learners will have changed roles and new activities as a result of this technological change.
>
> A new kind of professional will be required to provide leadership in design, implementation and evaluation of programs of education which make the fullest use of [educational technology] . . . (Morris, 1963, pp. 10, 11)

The definition of educational technology is made up of, and uses, many concepts—each of which must be defined and understood if the full definition is to have any meaning.

Education and Instruction. To many, the terms education and instruction are synonomous. This equation of the two terms is erroneous, and leads to confusion in defining educational technology.

Education is a broad, total concept:

> . . . the aggregate of all the processes by means of which a person develops abilities, attitudes, and other forms of behavior of positive value in the society in which he lives. (Good, 1973, p. 202)

Instruction, on the other hand, is a specific subset of education:

> . . . the process whereby the environment of an individual is deliberately managed to enable him to learn to emit or engage in specified behaviors under specified conditions or as responses to specified situations. (Corey, 1967, p. 6)

Education, then, includes two classes of processes not included in instruction: those processes related to the administration of instruction (*e.g.*, personnel, scheduling, food and transportation, finances) and those processes related to situations in which learning occurs when it is not deliberately managed (*e.g.*, outside of school, incidental learning, using noninstructional resources—television, museums). Instruction is a subset within the total process of education.

Does the concept technology have any unique impact on the processes of education and instruction?

Technology. To some, technology denotes only machinery—and in the case of educational technology, the machinery used in education. The President's Commission took this view when it defined instructional technology as "the media born of the

communications revolution" and looked at the "pieces [machines] that make up instructional technology" (1970, p. 21).

This view of technology is incomplete. As mentioned earlier, machines "are the *symbols* of instructional technology" (Finn, 1961, p. 32). Technology is a much larger concept.

> Technology means the systematic application of scientific or other organized knowledge to practical tasks. (Galbraith, 1967, p. 24)

> Technology is *not* just machines and men. It is a complex integrated organization of men and machines, of ideas, of procedures, and of management . . . . the term "educational technology" *expands* the areas of theoretical development, research and implementation in education. (Hoban, 1965, p. 124)

> Technology includes processes, systems, management and control mechanisms, both human and non-human, and above all . . . a way of looking at problems as to their interest, and difficulty, the feasibility of technical solutions, and the economic values–broadly considered–of those solutions. (Finn, in Eboch, 1963, p. 17)

Applied to education, technology is a complex, integrated process for analyzing problems, and of devising, implementing, managing and controlling and evaluating solutions to those problems.

Tasks. The application of technology to education and instruction have many important consequences for these processes. "Its most important consequence . . . is in forcing the division and sub-division of any such task into its component parts." (Galbraith, 1967, p. 31) The result of applying technology, then, is a division of the processes of education and instruction into their component tasks. A task is:

> . . . one of the distinct activities that constitute logical and necessary steps in the performance of work by the worker (U.S. Department of Labor, 1972, p. 3).

More specifically, *a task,* (as derived from Hyer, *et al.*, 1971, p. 46) is an activity which is an observable and/or measurable unit of work done by a person or machine which has a direct or immediate outcome, and which, with other tasks, contributes directly to the accomplishment of a goal or purpose.

An example of a task, according to these definitions, is "Operates camera (activity) to take slides (outcome) to produce slide presentation (purpose)."

The division of the processes of educational and instructional technology results in the identification of thousands of tasks. Task management becomes a central issue.

Functions. Tasks are more easily managed if grouped according to some type of similarities. Functions represent such a grouping of tasks. Grouping by functions differs from grouping by job or job title and gives more accurate groupings.

> . . . In the field of instructional technology, these . . . have taken the form of Building Coordinator, Librarian, IMC Director, Film Producer, Graphic Technician, Professor, and the like. These jobs . . . are *not very useful in describing either what the individual actually does on the job or how one job differs from another job.* Therefore, neither a listing of, nor a classification of, jobs . . . provides the organization needed (Wallington *et al.*, 1970, p. 295; italics added).

The concept of functions remedies these problems. Functions are not new to educational technology (see Ely, 1963; Morris, 1963; Eboch, 1963). A function is defined as:

> . . . a unique cluster of tasks which have a common and unique set of *activities, outcomes,* or *purposes* . . . . (Hyer, *et al.*, 1971, p. 47)

A function is not the same as a job. "Function" has several advantages over "job" as an organizer of tasks in educational technology. Grouping tasks by function:

considers the activity, outcome and purpose of the task in grouping;

is based on what gets done rather than on who performs the task, where, or on what job;

sets up mutually exclusive groupings by using unique sets of activities, outcomes, and purposes;

is based on a theoretical rationale—the definition of educational technology—rather than on haphazard practice.

Therefore, educational and instructional technology will be defined in terms of functions, based on tasks found in the application of technology to the processes of education and instruction.

CONCEPTUAL DEFINITION OF EDUCATIONAL TECHNOLOGY

Educational technology is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems, and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning. In educational technology, the solutions to problems take the form of all the *Learning Resources* that are designed and/or selected and/or utilized to bring about learning; these resources are identified as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems, and devising, implementing and evaluating solutions are identified by the *Educational Development Functions* of Research-Theory, Design, Production, Evaluation-Selection, Logistics, and Utilization. The processes of directing or coordinating one or more of these functions are identified by the *Educational Management Functions* of Organization Management and Personnel Management. The relationships among these elements are shown by the Domain of Educational Technology Model:

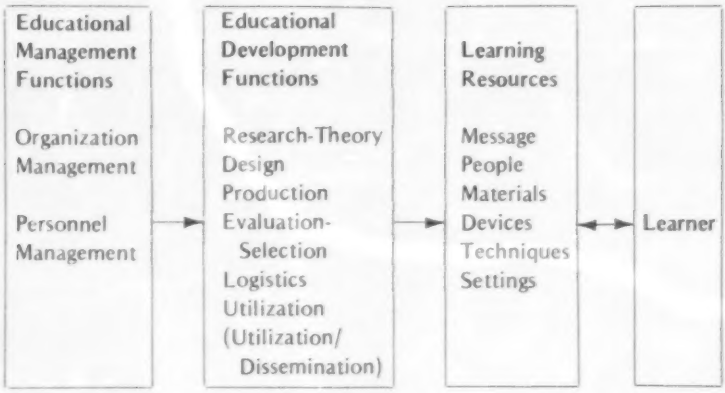

Figure 4.1
DOMAIN OF EDUCATIONAL TECHNOLOGY

The elements of the DET Model are defined in Tables 4.1, 4.2, and 4.3.

Table 4.1
Learning Resources/Instructional System Components

Learning Resources (for Educational Technology)—all of the resources (data, people, and things) which may be used by the learner in isolation or in combination, usually in an informal manner, to facilitate learning; they include Messages, People, Materials, Devices, Techniques, and Settings. There are two types: (a) resources by design—those resources which have been specifically developed as "instructional system components" in order to facilitate purposive, formal learning, and (b) resources by utilization—those resources which have not specifically been designed for instruction but which can be discovered, applied, and used for learning purposes.

Instructional System Components (ISC) (for Instructional Technology)—those learning resources which are prestructured in design or selection *and* utilization, and combined into complete instructional systems, to bring about purposive and controlled learning.

Resource or Component	Definition	Examples
Message	Information to be transmitted by the other components; takes the form of ideas, facts, meanings, data.	Any subject matter/content, *e.g.*, the history of the Greeks; Ohm's Law; World Series results; the parliamentary system of government; conjugation of the verb "to be."
People	Persons who are acting to store and/or transmit Messages.	Teacher; student; actor; speaker.

Learning Resources/Instructional System Components

Resource or Component	Definition	Examples
Material	Items (traditionally called media or software) which usually store Messages for transmission by devices; sometimes self-displaying.	Overhead transparency; slide; filmstrip; 16mm motion picture; 8mm motion picture; videotape; record; audiotape; programed instruction materials; computer-assisted instruction program; book; journal.
Device	Items (traditionally called hardware) which transmit Messages stored on Materials.	Overhead projector; slide projector; filmstrip projector; 16mm film projector; 8mm film projector; videotape recorder; television set; record player; radio; tape recorder; dial access information retrieval system console; teaching machine; talking typewriter; computer output devices.
Technique	Routine procedures or precast molds for using Materials, Devices, Settings, and People to transmit Messages.	Computer-assisted instruction; programed instruction; simulation; gaming; discovery; inquiry; field trip; team teaching; individualized instruction; self-instruction; group instruction; lecture; discussion.
Setting	The environment in which the Messages are received.	*Physical:* school building; instructional materials center; library; studio; classroom; auditorium. *Environmental:* lighting; heating; acoustics.

Table 4.2
Educational/Instructional Development Functions

Functions which have as their purpose analyzing problems, and devising, implementing, and evaluating the Learning Resources/ Instructional System Components solutions to these problems.

Function	Definition	Examples
Research-Theory Purpose:	To generate and test knowledge (theory and research methodology) related to the functions, Learning Resources and Instructional System Components and learners.	To conceptualize theoretical models. To conduct research projects. To analyze research data.
Outcome:	Knowledge which can act as an input to the other functions.	To generate new ideas. To test validity of model. To test hypotheses.
Activity:	Seeking information, reading it, analyzing it, synthesizing it, testing it, analyzing test results.	Reads proposal. Compares model with known data. Formulates specific hypotheses.
Design Purpose:	To translate general theoretical knowledge into specifications for Learning Resources or Instructional System Components.	To design programed instruction materials. To develop instructional modules for individualized instruction. To design equipment systems.

Educational/Instructional Development Functions

Function	Definition	Examples
Outcome:	Specifications for production of Learning Resources and Instructional System Components, regardless of format or resource.	To write general objectives. To determine medium. To describe technical systems.
Activity:	Analyzing, synthesizing, and writing objectives, learner characteristics, task analyses, learning conditions, instructional events, specifications for Learning Resources and Instructional Systems Components.	Analyzes objectives. Synthesizes objectives/sequence/content/media. Arranges materials in sequence.
Production Purpose:	To translate specifications for Learning Resources or Instructional Systems Components into specific actual items.	To produce audiotapes. To direct motion picture. To write computer programs for computer-assisted instruction.
Outcome:	Specific products in the form of test versions, prototypes, or mass-produced versions.	To make slides into test filmstrips. To decide on music/sound effects. To match audio and visuals.
Activity:	Operating production equipment, drawing, laying out, writing, building products.	Mixes narration tape and sound. Sequences slides using viewer. Operates motion picture camera.

Educational/Instructional Development Functions

Function	Definition	Examples
Evaluation-Selection Purpose:	To assess acceptability of actual produced Learning Resources or Instructional System Components in terms of criteria set by other functions, and to develop models for this assessment.	To pilot test prototype instructional materials. To preview and select instructional materials. To develop evaluation models and techniques.
Outcomes:	(a) Evaluation for Design: effectiveness of Learning Resources or Instructional System Components in meeting their objectives. (b) Evaluation for Production: acceptability of items in meeting production standards. (c) Evaluation for Evaluation: evaluation models. (d) Evaluation for Selection: acceptability of items for acquisition for a specific purpose. (e) Evaluation for Utilization: acceptability of items for meeting learning objectives in actual use.	To identify problems with materials. To identify objectives not met. To insure acceptable sound quality.
Activity:	Analyzing quality in terms of standards.	Observes students using materials. Analyzes possible uses of materials. Compares data and objectives.

Educational/Instructional Development Functions

Function	Definition	Examples
Logistics Purpose:	To make Learning Resources and Instructional System Components available for other functions.	To have equipment ready as needed. To provide delivery service. To catalog materials.
Outcome:	Ordered, stored, retrieved, classified, catalogued, assembled, scheduled, distributed, operated, maintained, and repaired Learning Resources and Instructional System Components.	To cross-index materials. To locate materials for delivery. To keep repair history. To repair filmstrip projector.
Activity:	Ordering, storing, retrieving, classifying, cataloging, assembling, scheduling, distributing, operating, maintaining, repairing Learning Resources and Instructional System Components.	Threads movie projector. Assigns media code from list. Plans new scheduling system.
Utilization Purpose:	To bring learners into contact with Learning Resources and Instructional System Components.	To help student use learning activity. To monitor individualized and self-instruction. To help student select learning activities and to meet objectives.
Outcome:	Facilitation and assessment of student learning.	To analyze student learning style. To present information. To encourage interest in learning activity.

Educational/Instructional Development Functions

Function	Definition	Examples
Activity:	Assigning, preparing learner for, presenting, assisting, and following up Learning Resources and Instructional System Components; testing learners.	Discusses with student. Compares learning activities with learning style. Compares pre- and post-tests.
Utilization-Dissemination Purpose:	(A special subfunction of Utilization.) To bring learners into contact with information about educational technology.	To consult on materials design and use. To teach photography course. To explain individualized instruction project. To increase use of learning resources center services by teachers.
Outcome:	Dissemination of information about educational technology.	To provide models for designing instruction. To improve use of mediated instruction by teachers. To answer questions about individualized instruction project. To demonstrate projector. To explain learning resources center services to teachers.
Activity:	Taking in and giving out information about educational technology.	Defines learning resources center services available. Writes professional articles. Views microteaching lesson. Role plays teacher using mediated instruction.

Table 4.3
Educational/Instructional Management Functions

Functions which have as their purpose the directing or controlling of one or more of the Educational/Instructional Development Functions or of other Educational/Instructional Management Functions to ensure their effective operation.

Function	Definition	Examples
Organization/Management		
Purpose:	To determine, modify, or execute the objectives, philosophy, policy, structure, budget, internal and external relationships, and administrative procedures of an organization performing one or several of the Development functions or the Management functions.	To administer/direct project which includes two or more functions. To monitor and change operation of center. To provide secretarial services in an audio-visual center.
Outcome:	Policy, budget, plans, coordinated activities, administrative operations.	To prepare budget. To identify organization needs. To ascertain jobs to be done.
Activity:	Defining, writing, and carrying out procedures leading to the outcomes.	Reviews purchase orders. Designs new organizational model. Analyzes problems in project

Educational/Instructional Management Functions

Function	Definition	Examples
Personnel-Management		
Purpose:	To interact with and/or to supervise the people who perform activities in the functions.	To supervise personnel in graphics unit. To improve communications between technicians and artists. To staff projects
Outcome:	Interpersonal interaction, discussion, supervision, employment, and personal development.	To evaluate work performed. To encourage discussion. To supervise the repairperson.
Activity:	Discussing with and speaking to other people.	Negotiates with personnel department. Questions applicants. Talks with new employees.

RATIONALE FOR THE DEFINITION.

The ascending evolution of any field is marked by major changes in paradigms of that field. This definition represents the third major paradigm change in the field of educational technology. The other major paradigm changes are chronicled in Chapter III.

Although Kuhn would have us believe that new paradigms represent a complete break with previous paradigms, they are probably more Hegelian in nature—looking at problems in a new way, yet building in some way what has gone before.

This new paradigm for the field of educational technology presents a new approach to solving educational problems. The new approach is, however, a logical extension and expansion of the field and as such includes concepts identified in earlier "educational technology" paradigms. This critical concept and the relationship of the present paradigm to previous paradigms are covered later.

The use of a model to describe the new paradigm helps clarify and illustrate both the new approach to educational technology, and, at the same time, how this new approach builds on what has come before.

Rationale for Models and Modeling.

A model is a "conceptualization in the form of an equation, a physical device, a narrative, or a graphic analogue representing a real-life situation . . . either as it is or as it should be." (Silvern, 1965, p. 27) The model, while not the real situation, is a "replica of the original. The more faithful the replica, the better it is as a model . . . " (Heinich, 1970, p. 64)

Models serve purposes other than merely replicating the real-world. Models can be extremely helpful in predicting and forecasting—in finding out what changing various elements of the model will do to other parts of the model or to the model as a whole. Models fall into two broad classes: models *of* and models *for*. "[Models of] . . . are models of *explanation*. The term model *for* is prescriptive in intent, and its formulation is designed as directive." (Heinich, 1970, p. 68)

The model offered here as part of the definition contains elements of both descriptive and prescriptive models. It is strongly rooted in the real world, but anticipates and offers structure for some changes which are likely to come about as technology is increasingly applied to education and instruction. As a descriptive model, the model meets several criteria, it:

describes the field in a form which can be recognized by those who work in it;

describes the field with a scope broad enough to accommodate a range of philosophical viewpoints, and,

lends itself to further manipulation for the future.

As a prescriptive model, it offers the framework for a new approach to education and instruction showing the elements and interrelationships among these elements. As such, it has already been used to identify and categorize a variety of learning resources and the activities which lead to the development and utilization of these resources.

The model has also led to the identification of three discrete but related areas of work (see Chapter VII). The model will continue to be highly useful for prescription.

As pointed out earlier, the new definition and model directly relate to earlier definitions and descriptions of various elements of the field. The new definition has three major sections (not including the learner): Learning Resources/Instructional Systems Components, Educational/Instructional Development Functions, and Educational/Instructional Management Functions.

Rationale for Learning Resources.

The rationale for Learning Resources has four components; classification, a broad range of resources, media, and resources by design and utilization.

Classification. The classification—as opposed to the simple listing—of various resources for learning is a concept basic to previous definitions. This concept became highly visible in Dale's "Cone of Experience" (1954). However, the concrete abstract axis used by Dale is only one way of classifying learning resources.

The classification of learning resources in this model was first described in the Jobs in Instructional Media Study (Wallington, *et al.*, 1970) in terms of instructional system components.

> . . . it seems that the major role of the [Learning Resources] in learning and in instruction is to transmit some stimulus or some information to the learner. In an attempt to clarify the word "transmit" we can ask some of the famous newspaper reporter's questions: What, who, where, how. These simple questions do provide a useful procedure for organizing the [Learning Resources] dimension.
>
> The questions mentioned above, when applied to the transmission of information, are as follows:
>
> (1) What information is being transmitted?
> (2) What or who is doing the transmitting?
> (3) How is it being transmitted?
> (4) Where is it being transmitted?
>
> Further, since before information can be transmitted, it must be stored, question (2) can be expanded to add the following categories:
>
> (2a) What or who is storing the message to be transmitted?
>
> By providing categories of [Learning Resources] for the answers to each of these questions, [an] organization scheme follows, based on the purpose of the [Learning Resource] . . .
>
> The category names that the model attaches to the answer to each question appear below:
>
> (1) The information being transmitted . . . . . Message
> (2) Who or what is storing or transmitting. . . . . .Man
> Material
> Device
> (3) How (through what procedures) it is being transmitted . . . . . .Technique
> (4) Where it is being transmitted . . . . . .Setting
>
> (pp. 291-292)

The impact of communications theory on the field strengthened the concept of classifying people and the content of a message as separate resources.

There is a strong similarity between the classifications used here and those used in the 1963 definition model (Ely, 1963;

see Chapter III, p. 36). The most important differences in terminology between the current classification and the 1963 definition model is in the definition of the category "people." In the current definition, the term, "people," refers only to persons who are transmitters of information directly to the learner, and not to people who perform the functions. Other differences are: (1) "people" replaces "man" to eliminate the use of sexist terminology; (2) the old "media-instrumentation" is replaced by "materials" and "devices"—both used as explanatory terms in 1963; (3) "techniques"—another 1963 explanatory term—replaces the term "methods;" (4) the term "environment" is replaced by "setting" and is given more specific definition. The term "message" remains. Those terms also, in the current model, include a broader perspective of Learning Resources.

Broad Range of Resources. The list of Learning Resource categories includes resources well beyond the previously used, restricted list of common school materials. This decision is a direct result of the previously identified concept of technology; and from the idea that: "Resources provide the breadth that encompasses the traditional audiovisual field and the recent and the future developments in the field" (Torkleson, 1965, p. 200). Limiting the range of resources consequently limits the tools available to the field of educational technology, while viewing all resources as potential Learning Resources increases the tools available for education.

"Media." There has been a long, historical relationship between the terms "media" and "educational technology." While the term is a popular and a viable term, it nevertheless restricts the overall concept of resources. This restriction is the result of the ambiguous connotations associated with the term, "media." While most people agree that resources for learning encompass people, many simply do not think of people as being a medium. This confusion has brought about terms such as "nonhuman instruction," "mediated instruction," which do not include instruction mediated through people. Using the term "learning resources" (and instructional system components) with "people" as one class of resources (or components) clarifies this perspective.

Resources by Design and Utilization. The definition indicates that resources can be "designed and/or utilized" to facilitate learning. Resources designed to facilitate learning are familiar to most people.

However, not all learning resources were designed for the specific purpose of education. There is some doubt that great novels and plays, community facilities (*e.g.*, firehouses), cultural institutions (*e.g.*, museums) were designed specifically to teach school children subjects in the curriculum. That these resources are used to help people learn makes them Learning Resources. This second class of resources, resources by utilization, is as important as resources by design.

Under this rubric—learning resources by design and by utilization—the range of learning resources becomes incredibly broad. This position is clarified in an earlier definition statement by AECT (1972, p. 38);

> Some resources can be used to facilitate learning because they are specifically designed for learning purposes. These are usually called "instructional materials or resources." Other resources exist as part of the normal, everyday world, but can be discovered, applied, and used for learning purposes. These are sometimes called "real-world resources." Thus, some resources become learning resources by design and others become learning resources by utilization. This distinction is important because it makes clear the position of "non-instructional, real-world" resources as well as designed resources as an area of concern for educational technology.

Summary. The above four points—classification, a broad range of resources, expansion of the term media, and the concept of resources through design and/or utilization are fundamental to the rationale underlying the concept of learning resources/instructional system components.

Rationale for Educational Development Functions

The processes for analyzing educational problems, and for devising, implementing and evaluating solutions to those problems are identified as the Educational Development Functions.

Specific Educational Development Functions are derived from frameworks provided by the systems approach and the

instructional development process. Many different sets of functions have been identified: Ely, 1963; Silvern, 1965; Faris, 1968; Lange, 1967; Hamerus, 1968; Barson, 1967; Twelker, *et al.*, 1972 for example. These functions were synthesized in the final report of the Jobs in Instructional Media Study (Wallington, *et al.*, 1970) based on extensive job analysis research in educational technology. The study concluded that (p. 296):

> Starting with these conceptions, which all differ in some minor respects, it was possible to analyze, synthesize, and combine and finally arrive at the following list . . . [of] functions–each with a unique . . . [purpose and outcome] and set of activities:
> Research-Theory
> Design
> Production
> Evaluation-Selection
> Utilization [and Utilization-Dissemination]
> Support-Supply

The term "support-supply" was changed to the current "logistics" after the review of early drafts of NCES Handbook X on Educational Technology (NCES, 1975).

While most of the functions are obvious derivations from instructional development models, the Utilization/Dissemination function is unique. It refers to situations in which:

> . . . we are using Instructional Technology to teach about Instructional Technology [sic]. While there is no theoretical difference in *purpose* between teaching about biology and teaching about instructional technology . . . it seems that there are at least some interesting practical differences in the product [*outcome*] and the *activities.* These differences make it worthwhile to provide, in the model, a means for indicating that this special situation exists, and for indicating how it is similar to and differs from regular utilization. (Wallington, *et al.*, 1970, p. 296)

This book is an example of Utilization/Dissemination. The specific differences between Utilization/Dissemination and Utilization are found in the descriptions in Table 4.2 (p. 62).

Rationale for Educational Management Functions.

The development functions discussed in the previous section offer a structure for designing and selecting Learning Resources

and utilizing them with the learner. Yet, each function is presented as independent of the others. There needs to be overall coordination and direction of the development function(s) either as they occur singly or in combination. The rationale for the two Educational/Instructional Management Functions—Organization Management and Personnel Management—is stated in the Jobs in Instructional Media Study report.

> While the idea of managing instruction is not a new one—school boards, superintendents of schools, principals, and others have administered, supervised, and planned the educational process for many years—the concept of instructional management within the framework of instructional technology is new (Heinich, 1967). In addition, a functional approach, such as is being used in this model, to management in education is also new. Thus, there are few guidelines for organizing the management functions dimension of the model (Wallington, *et al.*, 1970, p. 24).

The study further delineates a difference in kind between the "administration of an organization" (and its implicit paperwork) and the "supervision of people,"—calling for human relations skills. Thus the study identified two management functions:

> Based on this distinction, the Management Functions are two: Organization Management and Personnel Management. It might be argued that each of these could be broken down further . . . . This might be so, however, we presently feel that not enough is known about instructional technology management (to) either identify all such (sub)functions or to make fine distinctions between them (p. 297).

Confusion of Educational Technology and Other Concepts. Educational technology is frequently confused with two related, but not identical, concepts: (1) technology in education, and (2) instructional technology. The rest of this chapter will explore and define these concepts to show how they differ from educational technology.

TECHNOLOGY IN EDUCATION

Educational technology is concerned only with the processes which are performed to design and/or utilize resources to facilitate human learning. The key element is the notion of *resources to facilitate human learning.*

The concept of technology (as defined earlier in this chapter) may be applied to other aspects of the educational enterprise as well. The "complex, integrated process . . . " of technology may be applied, for example, to pupil transportation, to food and health services, to finances, to scheduling of rooms, and to reporting grades. While these are all certainly legitimate applications of technology, they are *not* educational technology.

Their focus is on the operation and support of the institutions in which education takes place, rather than being on the resources to facilitate human learning. The processes used here are best called "technology in education" and are not the same as educational technology.

CONCEPTUAL DEFINITION OF INSTRUCTIONAL TECHNOLOGY

Commonly, the concepts of educational technology and instructional technology are used synonomously—as equivalants. In the context of the present definition, this is inaccurate. The complete definition of instructional technology is given below to clarify the differences.

Instructional technology is a sub-set of educational technology, based on the concept that instruction is a sub-set of education. Instructional technology is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems, and devising, implementing, evaluating and managing solutions to those problems, in situations in which *learning is purposive and controlled.* In instructional technology, the solutions to problems take the form of *Instructional System Components* which are pre-structured in design or selection, *and* in utilization, and are combined into complete instructional systems; these components are identified as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems and devising, implementing, and evaluating solutions are identified by the *Instructional Development Functions* of Research-Theory, Design, Production, Evaluation-Selection, and Utilization. The processes of directing or coordinating one or more of these functions are identified by the *Instructional Management Functions* of

Organization Management and Personnel Management. The relationships among these elements are shown by the Domain of Instructional Technology Model:

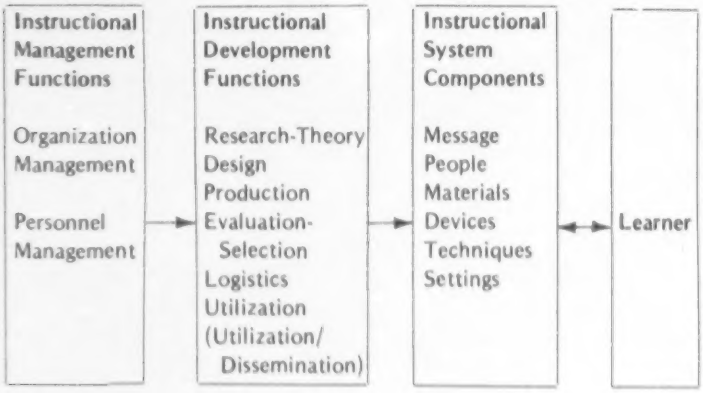

Figure 4.2
DOMAIN OF INSTRUCTIONAL TECHNOLOGY

Sub-set. Just as instruction is a sub-set of education (see "Underlying Concepts" in this Chapter), so instructional technology is a sub-set of educational technology. It is not concerned will all the things educational technology is—*all* the processes of education—but rather is concerned only with some of those things. The characteristics of instructional technology are specified below.

Purposive and Controlled Learning. While educational technology is concerned with "all aspects of human learning," instructional technology is only concerned with those situations in which the learning is "purposive and controlled." Purposive learning is learning in which someone else has determined that learning is to occur within the learner. Further, the purpose of such learning can, and must be, specified in advance. Controlled learning is learning in which the contingencies of the learner's behavior are determined and managed by someone else (Skinner, 1968). Further, these contingencies are built into the resources, and are monitored by People, Materials, Devices, and/or Techniques.

Pre-structured. The definitions of controlled and purposive learning lead to the next characteristic of instructional technology. The resources used by the learner are structured in advance, before the learner comes into contact with them. Both purpose and control of the learning are specified in advance.

Design, Selection, and Utilization. While educational technology includes all resources that are "designed and/or selected and/or utilized" to bring about learning, instructional technology sets more rigorous requirements on the resources with which it is concerned. Resources in instructional technology must meet both of the following requirements. First, the resources must be pre-designed or pre-selected in terms of the purpose of the learning and the control required for the learning. Second, they must be utilized in the manner for which they were designed or selected—*i.e.*, they must be used for the purpose specified, and they must be used in a manner which includes the element of control over the contingencies of behavior. Thus, while in educational technology any resource that meets one of the three criteria—design, *or* selection *or* utilization—is acceptable, in instructional technology a resource must meet at least two of the three criteria—it must either be designed *and* utilized, or selected *and* utilized. Further, the design and utilization, or selection and utilization, must be pre-structured in terms of purpose and control.

Instructional Systems/Instructional System Components. Since the resources in instructional technology must meet these additional requirements, it is not appropriate to consider them as "isolated resources." In order for all the elements above to be present, the resources must be combined into a complete instructional system. An instructional system is defined as:

> A combination of Instructional System Components (including a technique plus any one or more of the other Instructional System Components) and a specified management pattern which is pre-structured in design or selection, and in utilization, to bring about purposive and controlled learning, and which: a) is designed to achieve specified competencies or terminal behaviors for a total course of instruction; b) includes the instructional methodology, format and sequence called for in the design; c) manages the contingencies of behavior; d) includes a complete set of management procedures for

using the system; e) is replicable and reproducible, f) has been developed through the complete instructional development process, and g) has been empirically validated. (D & T Committee, AECT 1977)

In instructional technology, resources are seen as components of a complete instructional system, and are logically called Instructional System Components instead of resources.

Inclusiveness. All of the above differences between educational and instructional technology can be summarized by the final paragraph of Part 3 of the Definition of Educational Technology, p. 2. Thus, all of instructional technology fits within the parameters of educational technology, while all of educational technology does not fit within the parameters of instructional technology.

If instructional technology is in operation, then of necessity, so is educational technology; the reverse is not necessarily true. In educational technology, the Development and Management Functions are more inclusive because they apply to more Learning Resources than just Instructional System Components—they include all resources that can be used to facilitate learning.

SUMMARY

This chapter has presented the conceptual definition of educational technology, which includes:

a description of its underlying assumptions and concepts;

a description of the differences between "educational technology" and "technology in education," including a definition of the latter concept;

a definition of "instructional technology" and an analysis of it as a sub-set of educational technology.

This is not, however, the complete definition of educational technology.

While it is a complete conceptual definition, it does not serve to define educational technology as a field or as a profession—two criteria any complete definition must meet. The next four chapters draw from this conceptual definition the definitions of educational technology as a field and as a profession.

It must be stressed that all three definitions, rather than just the one contained in this chapter, represent the complete definition of educational technology.

CHAPTER V

Intellectual Technique– Functions, Combination of Technologies, Systematic Application of a Synergistic Effect

The theoretical framework provides the basis for meeting the second criterion for defining a field. It indicates the existence of a unique intellectual technique.

TECHNIQUES OF THE FUNCTION

As identified and defined by the Domain of Educational Technology Model, each of the Educational Development and Management Functions has an intellectual technique of its own. Each function involves people, procedures, ideas, devices, and organization for identifying and solving the problems which fall within the purview of its purpose.

The intellectual technique (the way of thinking through challenges) used in the Research-Theory Function to generate and test knowledge, for example, is the scientific method. The technique used in the Design Function to create specifications for Learning Resources is the instructional development process.